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ISIS

**International Review devoted to the History
:: of Science and Civilization ::
Quarterly Organ of the History of Science Society**

FOUNDED AND EDITED BY

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VOLUME XI

1928

THE SAINT CATHERINE PRESS LTD.,

35, rue du Tram, BRUGES (BELGIUM)

Printed in Belgium

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International Review devoted to the History of Science
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(Edited in Cambridge, Massachusetts, January 1928.)

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Preface to Volume Eleven

PASTEUR's first scientific achievement was his discovery of the true nature of the paratartaric (or racemic) acid. This substance had been obtained accidentally in 1819 or 1820 by an Alsatian manufacturer called KESTNER. Later it was shown to be equivalent to the tartaric acid which SCHEELÉ had extracted as early as 1769 from the « tartar » deposited in wine casks — entirely equivalent except in one respect. If polarized light was caused to pass through a solution of tartaric acid, the plane of polarization was turned; on the contrary the paratartaric acid was optically neutral. This had baffled BIOT and GAY-LUSSAC, and, as late as 1844, MITSCHERLICH had declared himself unable to account for this strange dissimilarity. Young PASTEUR kept pondering upon this for many years, in the meanwhile studying crystallography, and in the spring of 1848 had the genius to link the facts whose combination would explain this mystery. He crystallized paratartaric salts, and observing the crystals under the microscope, discovered that they were of two types, of which one was like the image of the other in a mirror. If these two types of crystals were isolated, and each was again dissolved, one obtained two solutions, both of which were optically active, but one of which turned the plane of polarization to the right and the other to the left. The paratartaric acid was optically inactive, simply because it contained equal amounts of dextrogyre and laevogyre crystals, which neutralized each other.

This remarkable discovery was brought to the knowledge of BIOT, who was then seventy four years old. He expressed interest, but with some scepticism which his age and experience and PASTEUR's youth justified. The young chemist offered to demonstrate the matter to him, and this was done with considerable care on the part of both men. PASTEUR was anxious to give a good demonstration; BIOT was equally anxious not to be fooled.

Paratartaric crystals having been obtained, PASTEUR showed

that they were of two kinds, right and left. « Do you really maintain, » said BIOT, « that one kind of crystals will turn the plane of polarization to the right, and that the other kind will turn it to the left ? »

« Yes, » answered PASTEUR.

« Well, leave me alone — I'll do the rest. »

After having himself prepared the two solutions, BIOT recalled PASTEUR, and made the final verification in his presence. Everything happened as PASTEUR had foretold. Thereupon the old man took him by the arm and exclaimed : « My dear child, I have loved science so much all my life that this makes my heart beat. »

*
* *

This story is not new, but it cannot be told too often. PASTEUR's discovery proved to be the beginning of a new branch of chemistry of enormous importance, but when the old man said, « This makes my heart beat, » he was not thinking of the future. Neither of them was then thinking of it but only of the particle of truth which it had been their privilege to see revealed, and which was infinitely precious to them, irrespective of its consequences. This illustrates the true spirit of science, a spirit which has been hovering over mankind since the very dawn of civilization, but which relatively few men have grasped and fewer still, nourished. It illustrates the Spirit of Man and it is with the history of that very spirit that we are mainly concerned. It is that history — the history of art, the history of science, the history of religion — that gives a meaning to our life. Our lives are interesting (that is, if they are interesting at all) because they continue such traditions, however humbly; for otherwise what would the continuation of our flesh and bones matter ? It is the spirit alone that signifies; the rest is like a mouldiness that spreads wherever it can, like a blind spawning in the ocean, like the other forces of nature, thoughtless, heartless, without conscience.

It is the spirit alone that matters. This is obvious enough, but we forget it all the time. And even the very servants of the spirit have to be reminded of it. For it takes energy to stand up, and, we all get tired; we are often rejected and sometimes discouraged. There are hours when our light shines like a bright

star in the night; but others when it is dimmed. We have been weak and we shall be weak again, but these times of failure do not represent our true selves. We are ourselves, not when we are sick and down, but when we are standing up and fighting all that is evil, commonplace, conventional or snobbish, all that is spiritless, fighting that immeasurable dead weight which would drag us down again; we are ourselves when we are standing up and loving all that is pure and as disentangled as possible from the things that die. We are at our best when we continue the highest traditions of mankind by the creation of beauty or the unveiling of truth. It is well to venerate such traditions and to have a grateful heart; it is better to continue them — to go forward.

To go forward ! What does this mean ? It does not mean only what it says. In my mind, it means a little more, for it implies consciousness. My hero is not simply the pioneer, the victorious inventor who blazes new paths, or makes two blades of grass grow where only one grew before. My hero goes forward but, from time to time, looks backward; he makes sure that he thoroughly understands the traditions which he is trying to continue, he makes sure that he is leading his fellow men and not misleading them. He is not simply a pioneer, but also a poet and an artist; most pioneers are not. To increase our power over nature, our wealth, our comfort, to lengthen our lives, is meritorious but secondary. The truly noble achievement is to add beauty or joy to the world, to deepen our disinterested understanding of it or of ourselves, to intensify our communion with it. All that strengthens the spirit of man is great; all that weakens it is mean. The New Humanist looks backward for the peace of his conscience and the joy of his heart, but he never stops on the road; he goes forward. How could we really appreciate the traditions which give our lives their sacred meaning, if we did not continue them, or at least if we did not try to do so ? The past is full of beauty, but less so than the future. As long as we are really alive, our first allegiance is to the future; we shall belong to the past only when we are dead.



This then is the standard of *Isis* : pure science, pure scholarship.

Not more knowledge, — this is not so much our task, — but a purer knowledge, and one that shall be less hard, less sharp — and mellowed by charity. Every author or editor writes for a definite public with a definite purpose. He may write to make children laugh or women blush, or more often, to make people pay; or else, he may write to arouse their sense of justice, to delight their hearts, to quicken their thoughts, to tell the truth as he sees it. Which is the public of *Isis* ? It is not easy to say, for the historian of science is still a very rare person; the number of professionals is still exceedingly small; in fact, it can be counted upon one's fingers. Our readers do not yet form a tangible and homogeneous group. However, we have already explained more than once what the Editor of *Isis* was driving at, and we can readily say whom he is writing for.

We are writing mainly for two young men. One of them is a physicist. He is very ambitious but his thoughts are not of money or power; his ambition is to add something to our knowledge of the world, to our objective and common knowledge of it — to add a paragraph or a footnote in one of our scientific textbooks. That is *his* task, the source of his activity, but he is not lobsided. Indeed he is anxious to understand the relation of his effort to the efforts of other men of science, past and present. His mind is engrossed by the subject of his investigations, but his heart is hungry. He wishes to embrace the unity of science, to understand its genesis and evolution, to appreciate the convergent endeavors of artists, reformers, dreamers and holy men. The essential goodness of man reveals itself in many ways. Could these be unrelated ? Our young physicist feels all this and besides he does not imagine that he knows everything or that everything can be known. Science does not so much decrease the mystery of the universe as displace and localize it; it divides the light from the darkness. As the field of our knowledge widens, the boundary line which separates it from ignorance and mystery does not shorten, but on the contrary lengthens. Men of science are not afraid of mystery. It represents to them the thing to be conquered; the purpose and the romance of life; the eternal source of newness and youth.

This young scientist asks himself many questions which the technical journals do not answer; his excursions into the border-

lands of knowledge, along the uncertain frontiers of science, arouse in his mind many doubts and longings. He reads *Isis* because he hopes to find in it the answer to his questions, the solution of his doubts, the gratification of these extraordinary and irrepressible longings. *Isis* is his literary journal, his romantic friend. Sometimes he finds a valuable answer in it, more often not, but he remains faithful, for however meager the results, he is aware that he can find what he needs more readily in *Isis* than anywhere else. If he does not find more, it is not so much the fault of *Isis*, but because what he is looking for is something very rare and precious.

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The other young man is a scholar. He is, or aims to be, a complete mediaevalist. He is trying hard to understand the development of mediaeval thought in Europe, to grasp this development in all of its ramifications and also in its wholeness. He is not studying a solitary stream of thought, let us say, the Latin or the Arabic, but endeavors to understand as much as possible every stream and to evidence their reciprocal relations. Some thoughts were expressed in Latin, others in Greek, Arabic, or Hebrew, or in various vernaculars. How much was each people influenced by the others; how much, in its turn, did it influence the others? His ambition is to draw the map, so to say, of all these intellectual streams, to show the obstacles which they had to turn or to overcome, even as real rivers turn around the hills or dig valleys across them. Of necessity he lives far more in the past than does the young physicist. Yet he realizes that the past cannot satisfy all the longings of his heart. He is living *now* in a world that moves faster and faster. He is not willing to be abandoned, he must advance too and understand the general drift. He also realizes that to appreciate the past one must appreciate the present as deeply as possible; for the past was once the present, the fresh creation of living men; it was once just as alive and reckless as the present is or seems to be. He would read scientific journals, but most of these are too technical and discouraging, and they fail to answer his questions or to still his doubts. He reads *Isis*, as much of it as he can and cares to, because he is

aware that this is the best way of remaining in touch with the living world of science and of feeling a little at home in it. *Isis* is his scientific adviser. It answers only a few of his questions, yet he remains faithful to it, because he knows the difficulties of his quest and that he has a better chance of finding what he needs in *Isis* than anywhere else.

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These two young men are very different, yet they have an air of resemblance. They have come from opposite points of the intellectual horizon, but at the end of their long journeys, they find themselves surprisingly near. They symbolize very well the composite public of *Isis* : scientists nourishing historical interests and loving to look backward once in a while ; scholars who want to know something of that all-embracing and esoteric world of science which is surrounding them more and more closely. Indeed, the New Humanism is a double renaissance : a scientific renaissance for men of letters, a literary and artistic one for men of science.

The Editor's problem is how to satisfy equally well these two young men, who are alike in a few respects, but so utterly different in every other. This is very difficult but not impossible, and at any rate worth trying. It must and will be done. His success depends partly upon his own effort, largely upon the spontaneous efforts of his readers. How far is each of them willing to go in order to meet the others ? To be candid, the ideal public of *Isis* does not yet exist in any tangible size, but it is continually growing, and others — later, much later — will reap what we are sowing. That is all right. The only terrible thing would be if nobody reaped ; but no matter how late the husbandmen come, the harvest will be ready.

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* *

Pure science, pure scholarship. No compromise is possible here. Such compromise may be necessary and useful somewhere else, but here — in *Isis* — it would be a sort of betrayal. As this matter is often misunderstood, it is well to explain briefly what it implies and what it does not imply. It implies austerity, but it does not

imply any feeling of superiority or pride, anything aristocratic or contemptuous.

One hesitates to speak of purity or sanctity, because every time one does so one gives hypocrites a new opportunity. Everything authentic can be and will be counterfeited, but surely this cannot mean that one should never express the deepest aspirations of one's heart?

Pure knowledge is not reserved for a privileged group any more than charity or grace. The number of people who appreciate knowledge in an entirely disinterested way may be as small as that of the pure artists or of the saints, but there is no telling beforehand where they are. Genius and sainthood may be hereditary — every human quality is, to some extent — but they are not transmitted as rigidly as wealth or titles. The heir of a duke is a duke, the heir of Croesus is wealthy, but the heir of a man of genius is not necessarily a man of genius. He will not be counted such unless he prove himself to be one. Pure knowledge may be found wherever there are pure hearts, that is, everywhere in general and nowhere in particular.

Thus our appeal is not directed to any predetermined group of men, but to all men. The purity of one's knowledge is not a function of its size nor even of its depth. Any man will readily understand our message whose knowledge, however limited, is honest, and who does not boast or bluff. The fact that he will not appreciate everything which is printed in *Isis* hardly matters, for the essential is the message itself.

We insist above all upon austerity. The bane of our studies is that too many men of science approach them in a spirit of dilettantism. They may be extremely careful and austere with regard to their own work, but as soon as they touch history they expect to be entertained. Now this is preposterous. The history of science is like any other subject; it has its high spots, its dramatic moments, its romantic interludes, but these cannot be separated from the duller background without loss or danger. Men of science must learn that here as elsewhere it is best to leave things in their original setting. Those who want only the cream of history will never benefit by it, nay, they will hardly appreciate it when they get it; like people trying to feed on dainties alone, they will be surfeited before being nourished.

Austerity is thus only another aspect of unity. It is the wish to see things as they are in their natural relationships with other things, pleasant or dull; the wish to see wholes rather than fragments. It is a reaction against the natural tendency to pluck the flowers only and make anthologies. This healthy reaction is not the privilege of any definite group of people, of any obvious aristocracy. Any man who knows his own intellectual background well, and enjoys it quietly, and who will not allow himself to be unduly influenced by loud speakers, will readily understand this. Any man, who living a humble life, finds it possible to tear away from the newspapers and magazines and read slowly a good book, or who has enough stamina to resist the cheap seduction of the movies in order to attend a good play or listen to good music, or simply to walk wistfully in his garden, — any such man will help to restore the true values of life and to create a better world. Any such man will instinctively appreciate our effort, even if there be much in *Isis* which does not interest him.

The pure in heart who work honestly and unobtrusively, without snobbishness, without bluff, who perhaps long for fame yet know deep in themselves that fame might hurt them, — these are our most beloved public. For is it not one of the main duties of the historian of science, to reestablish some justice in the appreciation of men's works? It is almost impossible for contemporaries to be unprejudiced, and their judgments are more often erroneous than not; it is the historian's sacred task to correct them, as much as possible. On the other hand, the genuine man of science learns to appreciate modern judgments in the light of history. Thus if he be made of the real stuff, he will yearn not so much for the applause of his contemporaries, as for the dispassionate and considered judgments of posterity. A straightforward recognition of his efforts is enough to satisfy him, and even that, he realizes, is not essential. The only thing that matters is to do one's best.

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To illustrate my thoughts in another way, let us go together to the Civic Repertory Theatre (the old Fourteenth Street Theatre) in New York, to see EVA LE GALLIENNE and her company. Let

us go on a good night, for this admirable actress is not always equally successful in her choice of plays, and some of them are good, and others not so good. Let us go, for instance, when she interprets the *Master Builder* or *Three Sisters*. Her art is austere; nothing unnecessary, no trimmings. The austerity of art is not essentially different from the austerity of science, and her gospel is the same as ours. This helps to explain that there is nothing supercilious in our endeavor, for her attitude proves it very plainly. EVA LE GALLIENNE realized that to succeed at all in accomplishing her ideal, or a part of it, the first requisite was to cut away from the theatres of Broadway. In the vain attempt to satisfy the caprices of audiences, the majority of which is extremely sophisticated without being educated, she would have jeopardized her own standards. An actress trying night after night to earn the plaudits of such audiences is led gradually to exchange her purest ambitions for worthless things, she is bound to become a sort of prostitute — not a venial prostitute, who does nothing worse than to sell her poor little body, but one infinitely more miserable, who hawks her very soul.

There are all sorts of men and women, and there must be, to serve them, many types of education. But people who are sophisticated are beyond salvation, for their standards are false. As they are headed in the wrong direction, the more they progress, the worse they become. That is what EVA LE GALLIENNE understood and that is why she broke off from the Broadway crowds. There is no harm in being uneducated, but sophisticated snobs, male or female, are hopeless. An uneducated man or woman may be as pure in heart as the most educated; it is a matter of potentialities, which as long as they have not been smothered by false ideals, can always develop. It is for the pure in heart, whether educated or not, that EVA LE GALLIENNE is working and it is to them that she is giving every ounce of her energy, her very life. And we would say, it is for them, though in a very different way, that we too are working. The New Humanism is not a new kind of sophistication, but a higher education of the most austere and uncompromising type. Let other people lower their standards, we will keep ours aloft, high above the noisy and vulgar crowds, yet within reach of every pure heart.

*
* *

We are just as anxious to go forward as the most modern of the moderns; we do not mean to resist progress, but to resist extravagance and conceit. Nor do we mistake aimless motion for progress. We go ahead quietly, looking backward quite often for the joy of our eyes and the peace of our heart, and to express our gratitude to the pioneers of old. O Pioneers ! Perhaps we are pioneers too, but not more so than you were. We advance slowly and steadily like those experienced mountaineers who let the fools hurry at the beginning of the trail and beat them regularly in the end.

The great secret of art is to choose and to simplify. This is also the secret of science — simplification and unity. There can be nothing but chaos and confusion without them. And it is also the secret of happiness, to be content with little and forget one's self in it; not to want, but to make the best of everything. The Greeks had seen this ages ago : *μηδὲν ἄγαν*. Nothing superfluous. This is indeed the quintessence of pure art, of pure science, of happiness.

Cambridge, Massachusetts

GEORGE SARTON.

April 5, 1928.

Des Johannes Philoponos Schrift über das Astrolab

EINLEITUNG.

Die folgende Uebersetzung ist angefertigt nach dem einzig vorhandenen Druck, den H. HASE im *Rheinischen Museum*, Bd. VI, 1839, veröffentlicht hat. HASE benutzte 3 Ms. der Bibliothèque Nationale in Paris, von denen das älteste und beste aus dem XIV Jahrhundert stammt (bei HASE steht XVI. Jahrhundert, wohl ein Druckfehler). Ausser diesen dreien besitzt dieselbe Bibliothek noch 12 andere Ms. derselben Arbeit. Das Studium dieser Ms. veranlasste PAUL TANNERY zu seinen *Notes critiques sur le traité de l'Astrolabe de PHILOPON* (1). Diese Korekturen sind in meiner Uebersetzung berücksichtigt worden. In dem nicht veröffentlichten Nachlass TANNERYs fand sich auch eine französische Uebersetzung und ein Aufsatz über das Werk (2).

PHILOPONOS lebte im Anfange des VI. Jahrhunderts in Alexandrien. Er ist oft verwechselt worden mit JOANNES ALEXANDRINUS Grammatikus und Medikus der um 640 lebte, so von F. NAU in seiner Arbeit über SÊBÔKHÏ.

Die vorliegende Schrift ist die älteste über das Astrolab, die uns aus dem Altertum erhalten geblieben ist. Ihre grosse Bedeutung liegt darin, dass wir aus ihr erkennen, dass das Astrolab seit PTOLEMAIOS stets bei den griechischen Astronomen in Gebrauch gewesen ist, und dass es zur Zeit des PHILOPONOS ein bekanntes Instrument war. PHILOPONOS gibt nämlich zu seiner Schrift keine Figur, setzt vielmehr voraus, dass seine Leser das Instrument in Händen haben.

Das Astrolab war theoretisch begründet durch PTOLEMAIOS in seinem *Planisphaerium*, es ist aber anzunehmen, dass er auch

(1) *Mém. scient.*, IV, p. 243-260.

(2) G. SARTON, *Introduction*, I, p. 422.

über das Astrolab geschrieben hat, da PHILOPONOS an einer Stelle den Grund angibt, der den PTOLEMAIOS veranlasst habe, die Stundenlinien auf die Nachtseite zu verlegen. Im *Planisphaerium* kommen die Parallelen zum Horizont nicht zur Darstellung. Freilich ergibt sich diese aus der Konstruktion der Parallelen zur Ekliptik, die ihrerseits im Astrolab fehlen. Im *Almagest* ist das ebene Astrolab nicht genannt, sondern die Armillarsphaere trägt dort den Namen Astrolab. Dagegen empfiehlt PTOLEMAIOS im *Tetrabiblos* (3) das Astrolab als einzig sicheres Instrument zur Bestimmung der Geburtsstunde. Auch in der Folgezeit bis ins XVIII Jahrhundert wurde das Astrolab wesentlich für astrologische Zwecke benutzt. Für wissenschaftliche Beobachtungen ist es nicht geeignet, wenn man von der Zeitbestimmung absieht.

Es tritt nun die Frage an uns heran: Ist PTOLEMAIOS der Erfinder des Astrolabs? Zwei Gründe sprechen dagegen. NAU hat die Arbeit des SEVERUS SÊBÔKHÏ aus der Mitte des VII Jahrhunderts in Syrischem Text und in französischer Uebersetzung herausgegeben (4). In dieser Arbeit unterscheidet der Verfasser den Philosophen, der das Astrolab gemacht hat von dem Astronomen PTOLEMAIOS. Wichtig ist besonders die Stelle, an der es sich um die fünf Zonen am Himmel handelt. SEVERUS sagt zuerst, man finde als Grenze der immersichtbaren, arktischen Zone mit Hilfe des Astrolabs im vierten Klima den 36. Grad vom Nordpol, die tropische Sommerzone habe die Breite von 30. Grad, die aequatoriale Zone 48 Grad, die tropische Winterzone 30. Grad und die antarktische 36 Grad. Er fährt fort, es gibt noch eine andere Teilung, die der Philosoph gemacht hat, sie hat dieselben Gradzahlen. Drittens gibt es noch eine Einteilung, die durch den Astronomen PTOLEMAIOS gemacht wurde, arktische Zone 36 Grad 9 Min., tropische Sommerzone 30 Grad, aequatoriale Zone 23 Grad 51 Min. nördlich und südlich des Aequators. Die erste Einteilung ist richtig für das vierte Klima, in dem SEVERUS lebte, in Qen neshre am oberen Euphrat. Die zweite ist die seit HIPPARCH allgemein für die ganze Griechische Welt angenommene (5), es liegt ihr die Breite von Rhodos, 36 Grad

(3) III, cap. 2.

(4) *Journal Asiatique*, IX S., t. 13, 1899,

(5) GEMINOS, *Ἡσυχαστήριον*, cap. V, 48.

zu Grunde. Bei der dritten ist die Ekliptikschiefe 23 Grad 51 Min. des PTOLEMAIOS eingeführt. Dass aber PTOLEMAIOS die arktische Zone um 9 Minuten vergrößert habe, klingt ganz unglaublich. Für seine Rechnungen im *Planisphaerium* benutzt er den schon von ERATOSTHENES angegebenen Wert 23 Grad 51 Min. 20 Sek., gibt aber im letzten Kapitel, wo er von der praktischen Ausführung des Astrolabs spricht, für die Schiefe 24 Grad an. Aber es bleibt bestehen, dass SEVERUS einen Philosophen vor PTOLEMAIOS für den Erfinder ausgibt. Den zweiten Grund der gegen PTOLEMAIOS als Erfinder spricht, finden wir in der Beschreibung des *horologium anaphoricum* bei VITRUV (6). Diese Uhr besteht aus einer Scheibe, *Tympanum*, die der Spinne des Astrolabs entsprechend den Tierkreis trägt. In diesem Kreis ist für jeden Tag des Jahres ein Loch gebohrt, in das ein Stift mit einem die Sonne vortstellenden Knopf eingesteckt werden kann. Vor der Scheibe steht ein Drahtgestell, das aus den Stundenlinien gebildet wird. Die Scheibe wird durch Wasserkraft in 24 Stunden einmal herumgedreht, dabei gibt der Sonnenknopf die Zeit an. Voraussetzung dabei ist, dass der Tierkreis der Scheibe und die Stundenlinien die Lage haben, wie beim Astrolab. Dann aber ist diese Uhr nichts anderes als ein mechanisches Astrolab und ihr Erfinder, dessen Namen VITRUV nicht nennt, muss das Astrolab gekannt haben. Nun sagt VITRUV in demselben Kapitel bei der Aufzählung der verschiedenen Sonnenuhren: *arachnen* EUDOXUS *astrologus* (*sc. invenisse dicitur*), *nonnulli dicunt* APOLLONIUM. NAU setzt nun in der genannten Arbeit diese *arachne* gleich dem Astrolab, weil ein Teil des Astrolabs *arachne* genannt wird und erklärt EUDOXOS oder APOLLONIOS für den Erfinder des Astrolabs. Das scheint mir ein zu kühner Schluss. Ich glaube nicht, dass VITRUV das Astrolab gekannt hat, das *Horologium anaphoricum* wird er einem griechischen Werke entnommen haben. Gegen EUDOXUS, 408-355, und APOLLONIOS, wenn der Pergaeer gemeint ist, um 262, aber sprechen wichtige Gründe. EUDOXOS verlegte in seiner frühen Zeit die vier tropischen Zeiten auf den 8. Tag oder Grad von Widder, Krebs, Wage und Steinbock, später in die Mitte dieser Zeichen, seine Schule gründete er in Kycikos am Marmora-Meer, was mit der Breite von 36 Grad schlecht stimmt. Die Teilung des Kreises in 360 Grad kommt bei den

Griechen zuerst als Neuerung vor bei HYPsikLES, um 170, und HIPPARCH gilt als der erste Astronom, der sie bei seinen Instrumenten konsequent einführte. Endlich hat HIPPARCH die stereographische Projektion nach übereinstimmender Annahme als erster angewandt, und ohne sie ist das Astrolab nicht möglich. Und, wenn es nun festzustehen scheint, dass das Astrolab vor PTOLEMAIOS erfunden wurde, so möchte ich es dem grössten Astronomen des Altertums, HIPPARCH zusprechen. Für die arachne des EUDOXOS bleibe ich bei der Annahme, dass es sich um eine ebene vertikale Sonnenuhr handelt, deren Stundenlinien und Tierkreislinien mit einem Spinnennetz die grösste Aehnlichkeit haben. Bestärkt wird diese Ansicht noch durch eine weitere von VITRUV genannte Sonnenuhr, conarachne (nicht das unverständliche gonarche), der Kegelspinne, bei der die genannten Linien auf der Innenfläche eines Hohlkegels liegen (7).

Das *Astrolab* des PHILOPONOS enthält folgende Teile :

1. Den Behälter (*mater astrolabii*) mit der Aufhängevorrichtung, einem geteilten Quadranten auf der Rückseite und einer Kreiseinteilung in 360 Grad auf dem vorstehenden Rande der Vorderseite.
2. Scheiben für verschiedene Klimata, sie zeigen den Horizont mit seinen Parallelen und die Stundenlinien, tragen den Namen und die geographische Breite des Klimas und die Länge des längsten Tages.
3. Die Spinne mit dem Tierkreis und einer Anzahl heller Sterne.
4. Das Diopter, das auf der Rückseite liegt.
5. Die, die Teile zusammenhaltende, Achse.

Die gleichen Teile enthält das Astrolab SÊBÔKHYS, ob es ausserdem noch Azimutlinien enthielt, scheint mir zweifelhaft. Eine Stelle lautet nach NAU : *Le philosophe s'imagina de graver pour chaque climat sur les tablettes dont nous avons parlé, la hauteur qui va du sud au nord, puis d'écrire la longitude qui va de l'est à l'ouest et la même sur le bord de la tablette extérieure.* Unter longitude will NAU hier Azimut verstanden haben, er sagt aber, dass SEVERUS dasselbe Wort für angle horaire und longitude gebrauche. So halte ich es für möglich, dass es sich um eine

(7) RAYET, Sur les cadrans coniques. *Ann. de chimie et de physique* III^e Série, t. 6, 1875.

Kreiseinteilung handelt, wie sie auf manchen Scheiben vorkommt, *la même sur le bord*, umsomehr, als in der ganzen Arbeit nirgends vom Azimut die Rede ist.

Dagegen findet man die Azimutlinien schon in den ältesten arabischen Schriften über das Astrolab, bei MÂSHÂLLÂH. Ende des 8. Jahrh. und bei 'ALÎ IBN 'ÎSÂ, um 830. Es ist also möglich, dass diese Linien von den Arabern hinzugefügt wurden.

Erhalten ist uns kein Astrolab aus vorarabischer Zeit. Das älteste in der Nationalbibliothek zu Paris stammt aus der Zeit um 950, es war von AĤMAD BEN KHALAF für JA'FAR (906-987), den Sohn des Chalifen AL-MUKTAFÎ BILLÂH gemacht.

Zum leichteren Verständnis habe ich die Abbildung eines Astrolabs genau nach der Beschreibung des Textes hinzugefügt.

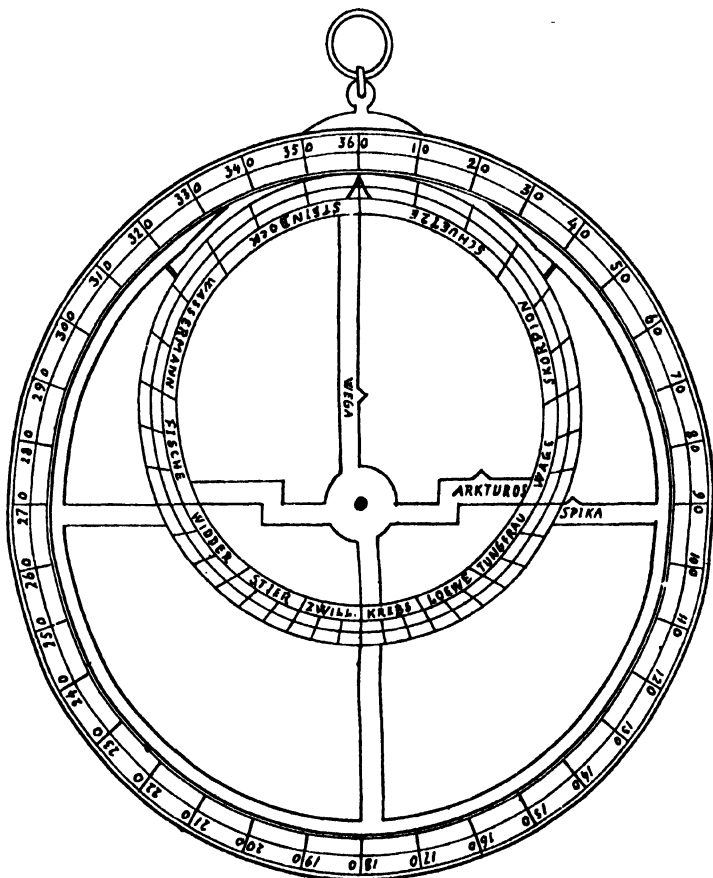


Abb. 1. Die Vorderseite des Astrolabs mit der eingelegten Spinne.

In der Spinne sind nur die drei im Text erwähnten Sterne an den Orten, die sie zur Zeit des PHILOPONOS inne hatten, angebracht.

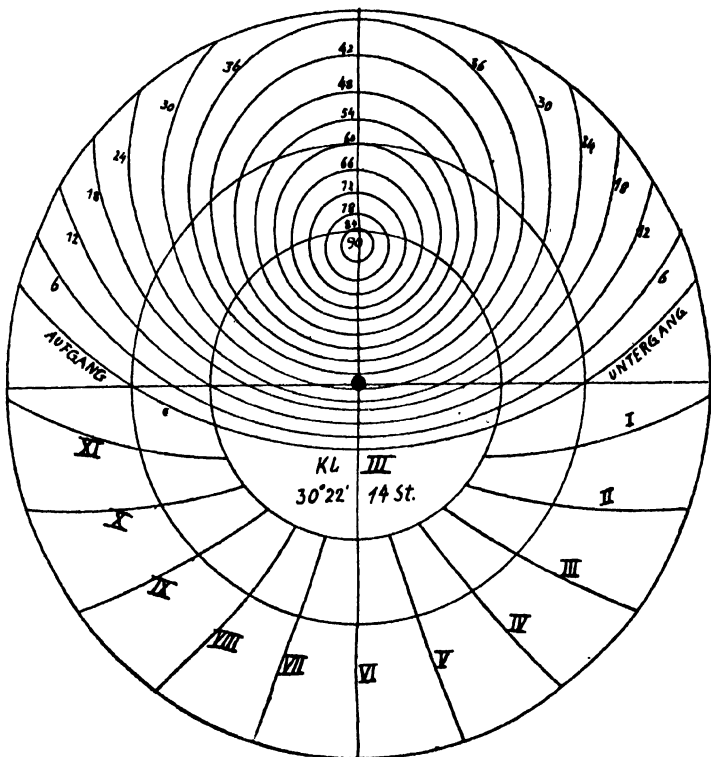


Abb. 2. Eine Scheibe für das dritte Klima.

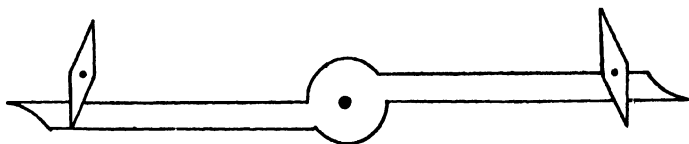


Abb. 3. Das Dioptr.

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ÜBERSETZUNG.

DES JOHANNES ALEXANDRINUS MIT DEM BEINAMEN PHILOPONOS
ABHANDLUNG ÜBER DEN GEBRAUCH UND DIE EINRICHTUNG
DES ASTROLABS UND DIE BEDEUTUNG ALLES AUF IHM VER-
ZEICHNETEN.

Ich werde versuchen, soweit ich dazu imstande bin, deutlich

zu erklären die Darstellung der sichtbaren Teile der Sphaere auf dem Astrolab und die Bedeutung des auf ihm Dargestellten, ferner seinen Gebrauch, und zu wie vielen und zu wie vielerlei Dingen es nützlich ist. Zwar ist es schon hinlänglich von dem Philosophen AMMONIOS, unserem Lehrer, bearbeitet, gleichwohl bedarf es noch weiterer Erklärung, damit es auch denen, die nicht damit vertraut sind, leicht begreiflich werde. Dies zu unternehmen, bin ich von Nahestehenden angeregt worden. Zuerst nun sprechen wir von jedem Einzelnen, was auf dem Astrolab eingezeichnet ist.

Ueber die Einzeichnungen auf der Fläche, auf der das Diopter liegt, und für was jegliches von dem Eingezeichneten die Erklärung gibt.

Die beiden Geraden also auf der Seite, auf der das Diopter liegt, die einander in der Mitte schneiden, entsprechen dem Meridian und dem Horizont. Die von oben, von dem Ringe, durch den wir das Instrument aufhängen, herab nach unten geht, entspricht dem Meridian für jedes Klima, die andere die jene rechtwinklig schneidet, entspricht dem Horizont. Ueber dieser, die dem Horizont entspricht, steht ein Halbkreis, der als Durchmesser diese Linie selbst hat, der also der über der Erde liegenden Halbkugel des Himmels entspricht. Diesen Halbkreis hälft die andere von den Linien, die von dem Ringe herabkommt, von der wir sagten, dass sie dem Meridian entspricht. Der Schnitt aber ist am oberen Ende der Linie, dem an dem Ringe. Jeder von den durch jede der Linien gebildete Quadrant ist in 90 Grad geteilt (8), durch die wir die Höhe über dem Horizont der Sonne oder irgend eines anderen Sternes messen, wie viel Grad er über dem oestlichen oder westlichen Horizonte zu jeder Stunde sich erhebt. Es ist aber der 90. Grad das Zeichen nach dem Zenit über jedem Ort, der erste Grad aber zeigt das, was beim Horizont selbst ist, entweder das Aufgehende oder das Untergehende, wie es der Gebrauch des Instrumentes uns im Weitergehen

• (8) HASE hat hier nach dem Zwischensatz « auf denen der Gradmesser des Diopters liegt » der ihn veranlaßt den Plural des folgenden Relativs in den Singular zu ändern.

Der Zwischensatz ist aus einer Randnote in den Text geraten (TANNERY).

lehren wird. Es ist aber nicht auf allen Astrolabien jeder der beiden Quadranten in 90 Grad geteilt, sondern nur einer von beiden, denn es reicht einer allein aus, welcher es zufällig sein mag, zum Visieren, denn an jedem von beiden ist zu erkennen, wie viel sich über dem westlichen oder oestlichen Horizont die Sonne oder irgend ein Stern erhebt. Aber damit uns das Visieren leichter wird, wenn wir das Instrument mit jeder von beiden Händen erheben, deshalb sind in manchen Astrolabien beide Quadranten gezeichnet.

Ueber die Darstellung auf den Scheiben, auf denen die Klimata eingeschrieben sind, und wem jedes Eingeschriebene entspricht, und wieviel Grad die Schiefe der Ekliptik hat.

Die Zeichnung der Fläche, auf der das Diopter liegt, ist also auf diese Art angeordnet, die aber auf den Scheiben, auf denen die Klimata angezeigt sind, verhält sich so. Auf jeder Seite der Scheibe sind wieder zwei Gerade, die einander in gleicher Art schneiden, von denen die Eine, da sie von den Ringe nach unten verläuft, wiederum dem Meridian entspricht, die Andere dem Horizont. Es sind dieselben Linien wie auf der gegenüberliegenden Seite, der das Diopter aufliegt. Deshalb sind sie jenen gleichgeordnet anzupassen. Es sind aber auch auf dem oberen, gegen das Gehänge gelegenen Teile der Scheibe Kreise gezeichnet, und zwar auf den eingradigen Astrolabien 90, auf den zweigradigen 45, wie auch auf den dreigradigen 30, oder wie es etwa den Verfertigern passte. Von diesen nun entspricht der äussere grössere dem Horizont, und wenn es möglich war den Kreis auszustrecken, so passt er sich der Graden an, die den Meridian schneidet. Da nun dies, übrigens natürlich, nicht möglich ist, so überragt so viel beiderseits von den Spitzen die Gerade, wieviel von seiner Krümmung von der Mitte der Geraden Abstand hat. Aber so wie die Gerade auf der Ebene die Grenze bildet zwischen der Halbkugel über der Erde und der unter der Erde, so tut es der Kreis auf der Kugel. Die aber im Inneren gelegenen und umschlossenen Kreise sind die Parallelen zum Horizont, sie haben einen gegenseitigen Abstand vom Horizont her nach dem oberen Teil, der dem über der Erde gelegenen entspricht, in den eingradigen Astrolabien von einem Grad, in den zwei-

und dreigradigen von zwei und drei Grad, so dass von ihnen die Halbkugel über der Erde kranzförmig geschnitten wird, welche Lage auch die Parallelkreise in der mühlenartigen Form des Alls haben (9). Daher sind immer die inneren, höher über dem Horizont gelegenen, notwendig kleiner, da sie einen kleineren Kreis von der über der Erde gelegenen Halbkugel abschneiden. Gezeichnet werden die genannten Kreise, denen die auf dem Instrumente entsprechen auf der Kugel um den Punkt im Zenit eines jeden Ortes als Mittelpunkt, als Radius dient beim Horizont die Linie, die vom Zenit aus durchgeht bis zum Ende (10) des Durchmessers des Ganzen, bei den folgenden nehmen wir immer von diesem Durchmesser einen Grad weg bei den eingradigen Astrolabien, oder zwei oder drei, wie bei den zwei oder dreigradigen. Es ist aber klar, dass, da dieser Radius 90 Grad hat, denn er hat den Bogen eines Quadranten, die Wegnahme soweit gemacht wird, bis dass der Abstand vom Zenit ein Grad ist wie bei den eingradigen, oder zwei oder mehrere, wie bei den übrigen. Der Punkt aber zwischen den Kreisen, an dem der 90. Grad angeschrieben steht, entspricht dem Zenit jedes Ortes, so dass dieser Punkt denselben Wert hat wie der obere Endpunkt der Linie auf der anderen Seite, auf der das Diopter liegt, also wie der gegen das Gehänge. Jedem der beiden Punkte ist dieselbe Zahl, 90 Grad, angeschrieben. Diese Kreise halbiert der Meridian, von dem wir gesagt haben, dass ihm die Linie entspricht, die von dem Ringe her durch diese Kreise hinabläuft, so dass die linksseitigen Halbkreise, wenn das Instrument unserem Auge gegenüber liegt, den Osten, wo auch der Aufgang angeschrieben steht, bedeuten. Hier befindet sich die Sonne und jeder Stern, wenn sie sich vom Aufgange bis zum Süden bewegen. Andersets bedeuten die rechtsseitigen den Westen, denen wiederum der Untergang angeschrieben ist, in ihnen befindet sich, was vom Süden sich bis zum Untergang bewegt. Offenbar aber sind wegen der beschränkten Ausdehnung des Instrumentes nicht alle Kreise vollständig, sondern die äusseren, grösseren über den Umfang der Scheibe hinausragenden sind nur halbvollendet.

(9) Die Ausdrücke kranz- und mühlenförmig finden wir schon bei älteren Griechen z. B. *μυλοειδὴς* bei THEODORET, *μυλοειδὴς κίνησις* bei AUTOLYKOS. *στέφανος* bei PARMENIDES.

(10) Nach der Korrektur TANNERY'S.

Es steht an diesen Kreisen ihre Zahl von 1-90, so viel Grade beträgt nämlich, wie ich sagte, der Abstand des Horizontes vom Zenit. Auch das muss klar sein, dass die Zählung von Horizonte an beginnt, indem ihre Zahlen bei den äusseren unvollständigen jedem ihrem Halbkreise, dem oestlichen und westlichen angeschrieben sind, bei den inneren und vollständigen ist die Gradzahl der Kreise angeordnet auf der Meridianlinie. Für selbstverständlich halte ich es, dass auf den zwei- und dreigradigen Astrolabien der Zwischenraum der Kreise abgegrenzt wird nach den ausgelassenen. Diese Kreise haben den gleichen Wert, wie die auf dem Quadranten der Fläche, auf der das Diopter liegt, eingetragenen Grade, über die wir im Anfang gesprochen haben. Der Halbkreis nun der Scheibe, auf dem die genannten Kreise eingezeichnet sind, entspricht der Halbkugel über der Erde, der Rest der unter der Erde, der geteilt wird in 12 Abschnitte nach der Zahl der 12 Stunden, welche in beiden Halbkugeln, sowohl der über der Erde, als auch der unter der Erde die sich bewegende Sonne verursacht. An diesen Linien ist auch die Zahl der Stunden angeschrieben, wobei die erste Stunde vom Untergang ihren Anfang nimmt, den Grund dafür werden wir im Weitergehen angeben. Es sind aber auch drei andre Kreise auf den genannten Parallelkreisen eingezeichnet, die diese schneiden, einander aber umfassen, von denen der innere dem Sommerwendekreis entspricht. Wird die Spinne herumgeführt, so wirst du sehen, dass der erste Grad des Krebses, in dem sie Sonne die Sommerwende macht, eben diesen Kreis beschreibt. Von ihm ist der Teil über der Erde der grössere, dies ist der durch die Parallelkreise geführte Teil, der kleinere, der unter der Erde, ist der, der auf dem übrigen Teile der Scheibe liegt, auf dem die Stundenlinien gezogen sind, der ja, wie wir gesagt haben, der unter der Erde gelegenen Halbkugel entspricht. Der zweite nach diesem und ihm benachbarte umschliessende Kreis entspricht dem Aequator, weshalb die beiden Tagnachtgleichenpunkte durch ihn hindurchgehen, der Anfang des Widders sowohl wie der Anfang der Wage. Von ihm sind beide Halbkreise gleich, der durch die Parallelkreise gezeichnete, der ja über der Erde ist, und der durch die Stundenlinien, der offenbar unter der Erde ist. Von diesen zwei Kreisen sind auf manchen Instrumenten nur die Halbkreise unter der Erde eingeprägt, die übrigen, die durch

die Parallelkreise zu führen waren, werden im Sinne gehalten, damit die Linien der Parallelkreise nicht von ihnen geschnitten werden. Der dritte aber, der die beiden umschliesst, ist dem Winterwendekreis gleich zu setzen. woher denn der Anfang des Steinbocks, durch den die Winterwende entsteht, diesen Kreis durchläuft. Und deswegen ist der Teil dieses Kreises über der Erde, das ist der durch die Parallelkreise gezogene der kleinere, der aber unter der Erde, der offenbar durch die Stundenlinien geht, der grössere. Von diesen drei Kreisen, ich meine den Sommerwendekreis, den Tagnachtgleichenkreis, und den Winterwendekreis trennt der erste Parallelkreis den über der Erde befindlichen Teil von dem unter der Erde, da wir doch auch sagten, dass er dem Horizont entspreche. (11) Es ist aber der Abstand vom Winterwendekreis zum Sommerwendekreis 48 Grad, wie an der Zeichnung der Parallelkreise zu erkennen ist. Der Sommerwendekreis steht nach dem Norden hin 24 Grad vom Aequator ab, die Winterwende nach Süden hin die üblichen 24 Grad. Passt du die Spinne irgendeinem der Klimata an und merkst dir den Parallelkreis, wo der gegen den Meridian hin gedrehte Anfang des Steinbocks haftet und dann zweitens, wo die Anfänge des Widders und der Wage haften, und drittens wo der Anfang des Krebses haftet und zählst die zwischen liegenden Parallelkreise, so wirst du von dem Steinbock bis zum Widder und der Wage 24 Parallelkreise finden, von dem Widder und der Wage bis zum Krebs die anderen 24, so dass es vom Steinbock bis zum Krebs 48 sind, welchen Abstand ja die Schiefe der Ekliptik inne hat. Eingetragen wird auch das Klima, für das auf jeder Fläche die Zeichnung gemacht ist, und wieviel Aquinoctial stunden der längste Tag in jenem Klima hat, und wie weit das betreffende Klima vom Aequator absteht. Um dieselben Grade erhebt sich offenbar der Nordpol über den Horizont, und steht der Südpol unter der Erde, denn es ist klar, dass der Nordpol soweit über dem Horizont erhoben ist und der Südpol unter der Erde liegt, als jeder Ort vom Aequator entfernt ist. Auf manchen Astrolabien und am meisten auf den eingradigen ist

(11) HASE hat hier noch den Satz « Von der Winterwende bis zur Sommerwende ist die Breite des Zodiakus 47 Grad 48 Minuten 40 Sekunden, der offenbar, weil im Widerspruch mit dem folgenden, aus einer Randbemerkung in den Text aufgenommen worden ist. Ptolemäus hat 47 Grad 42 Minuten 40 Sekunden. Die Zahl 48 Sekunden ist wohl als Schreibfehler anzusehen.

selbst die Fläche, auf der das Dioppter liegt, für irgend eins von den Klimaten gezeichnet. Bei manchen ist der äussere Umfang in 360 Grad geteilt.

Ueber die Eintragungen auf der Spinne.

Soviel über die Scheiben, und was jedes von dem darauf Dargestellten bedeutet. Die darauf liegende Spinne aber enthält den Tierkreis und einige von den helleren Fixsternen. Der vollständige von aussen her beginnende Kreis auf ihr ist eben der Tierkreis, die übrigen unvollständigen enthalten einige Fixsterne, über die wir zur rechten Zeit sprechen werden. Auf dem Tierkreis sind eingetragen die 12 Zeichen, vom Widder bis zu den Fischen. Jedes Zeichen wird auf den eingradigen Instrumenten in 30 Grad eingeteilt, auf den zweigradigen in 15 und natürlich auf den dreigradigen in 10, wie sich auch die Zeichnung der Parallelkreise verhält. Der Anfang der Grade jedes Zeichens liegt auf der Seite, gegen die der erste Buchstabe des Zeichens eingeschrieben ist, oder anders an der Seite, gegen die das ihm vorangehende Zeichen sich befindet, sowie das dem Widder vorangehende Zeichen die Fische sind, an dem Teil nun bei den Fischen ist der Anfang des Widders, und so ist es bei allen. Von den Strichen aber, die die Grade bezeichnen, die zum Teil durch die ganze Breite des Tierkreises hindurchgehen, zum Teil nur bis zur Mitte reichen, geben die ganz hindurchgehenden den Anfang eines jeden Zeichens, denn diese bilden das Ende des vorangehenden und den Anfang des folgenden Zeichens. Dies nun ist die Zubereitung des ganzen Instrumentes. Es ist an der Zeit das Uebrige und seinen Gebrauch vollständig darzustellen.

Ueber das Erspähen der Sonne am Tage, und wie wir es kunstgemäss handhaben.

Wenn wir am Tage mit dem Instrument die Stunde der Sonne erfahren wollen, dann heben wir das Instrument an dem Ringe, so dass der Quadrant auf ihm, der in 90 Grad geteilt ist, gegen die Sonne gerichtet ist, dann drehen wir nach und nach das Dioppter hinauf und hinunter längs diesen selben Quadranten hin, bis ein Strahl, der durch das gegen die Sonne gerichtete

Loch des Diopters gegangen ist, in das andere gegen uns gerichtete fällt. Damit wir aber nicht ohne Anwendung einer vernünftigen Methode das Instrument in bezug auf das Durchschauen falsch gebrauchen, ist es nötig, dass das Instrument eine solche Lage haben muss, dass sein äusserer Umfang, ich meine die Peripherie von der Sonne beschienen wird, jede der beiden Flächen aber im Schatten bleibt. Der Grund aber ist dieser, dass dem Pole des Horizontes, oder, was dasselbe ist, dem Zenit der Punkt der Aufhängung entspricht, dem Parallelkreis aber, den die gerade beobachtete Sonne trifft, der Umfang des Instrumentes. Dieser muss also so liegen, dass er in derselben Ebene mit dem Parallel, den gerade die Sonne trifft, liegt. Und es wird wohl so sein, wenn genau auf den Rand des Instrumentes die Sonnenstrahlen auffallen, gleich als ob das Gestirn auf ihm liege. Wenn nun das Instrument in diese Lage gebracht ist, muss das Diopter, wie ich sagte, sanft nach oben und unten gedreht werden auf dem einen Quadranten des getheilten Halbkreises, der gegen die Sonne gerichtet ist, bis, wenn das Diopter in gerader Linie zur Sonne liegt, der Sonnenstrahl, der durch das Loch des gegen die Sonne gerichteten Plättchens hindurch gegangen ist auch hindurchgeht durch das Loch des auf uns zu gelegenen Plättchens. Beim Drehen des Diopters wirst du das gleichgrosse und gleichgestaltete Licht um das Loch herumirren und durch die Bewegung des Diopters bald hierhin bald dorthin gelangen sehen. Man muss nun das Diopter langsam bald hierhin bald dorthin drehen, bis wir das Licht auf die innere Fläche des gegen uns liegenden Plättchens fallen sehen, und dass es sich dem Loch auf ihm anpasst, dann bleibt etwas von ihm übrig oder es wird selbst unsichtbar, gleich als ob es durch den leeren Raum ginge. Wenn du nun die Hand dem gegen uns zu gelegenen Loch näherst, wirst du das Licht auf sie fallen sehen. Allseitig unsichtbar wird das Licht, wenn die Oeffnung, durch die es zuerst gegangen, kleiner wäre als die zweite, oder ihr genau gleich; wenn sie aber grösser gefunden würde, so überragte das Licht die zweite Oeffnung auf der inneren Fläche des gegen uns zu liegenden Plättchens. Wenn dies nun zutrifft, so muss man mit Tinte oder dergleichen den Strich bezeichnen, auf den der Gradzeiger des Diopters fällt (das ist eben das in eine Schneide endigende Ende des Lineals) und messen, der wievielte es ist angefangen von unten am Horizont, ob es

nun vor Mittag war, als die Beobachtung gemacht wurde, oder nach Mittag. Wieviel Grad es nun sein mögen vom Horizont an, soviel beträgt auch die Höhe der Sonne vom Aufgang oder vom Untergang an. Nachdem wir bestimmt haben den Grad, in dem die Sonne beobachtet wurde, es sei etwa der dreissigste, müssen wir entweder das Tierkreiszeichen und seinen Grad, in dem an jenem Tage die Sonne ist, aus dem Ephemeriden entnehmen, wenn wir die Tagesstunde finden wollen, oder nach der Methode finden, die wir im folgenden anzugeben im Begriffe sind.

Ein Beispiel.

Die Sonne stehe etwa im 20. Grade des Widders. Man muss nun den 20. Grad des Widders im Zodiakus auf der Spinne mit Tinte, Wachs oder dergleichen bezeichnen, darauf zusehen, in welchem Klima wir beobachten, und die Scheibe nehmen, auf der das betreffende Klima eingeschrieben steht, und sie so dem vorliegenden Instrumente anpassen, dass das gesuchte Klima zu oberst des Ganzen liegt, und dann die Spinne darauf legen. Und wenn nun vormittags die Beobachtung stattfand, so muss man in der Scheibe des vorliegenden Klimas den dem beobachteten Grade gleichzahligen Parallelkreis nehmen, wie jetzt nach der Voraussetzung den dreissigsten, den Anfang der Zählung machend von den Theilen, in welchen Aufgang angeschrieben ist, wenn es aber nachmittags war, machen wir auf der vorliegenden Scheibe den Anfang dort, wo Untergang geschrieben steht. Dann muss man diesen Kreis mit Tinte in mehreren Punkten beinahe auf der ganzen Linie bezeichnen. Ist aber das Astrolab kein eingradiges, sondern ein zwei oder dreigradiges, und fällt die beobachtete Gradzahl in den Zwischenraum der Kreise, so muss man offenbar den Zwischenraum analog teilen, und den Ort, wohin die gesuchte Zahl fällt, in gleicher Weise mit mehreren Zeichen nach oben und unten hin zeichnen. Ist dies geschehen, so muss man die Spinne drehen, bis das Zeichen und der Grad, den die Sonne inne hat, dem Parallelkreise anliegt, in dem die Sonne beobachtet war, und den wir mit mehreren Punkten zu bezeichnen empfohlen, weil es sonst nicht zu erkennen wäre, an welchen von ihnen der Grad der Sonne haftet beim

Drehen der Spinne. Ist dies aber geschehen, so muss man wissen dass es, welche Lage das All in jener Stunde hat, feststeht, dass auch das Instrument dieselbe dem All gleichgeordnete Lage hat. Darauf muss man den Grad nehmen, der der Sonne diametral gegenüber liegt, wie jetzt den 20. der Wage und mit Tinte bezeichnen, in welchem Punkte der Scheibe er liegt. Er liegt aber durchaus in dem Teile, der dem unter der Erde Gelegenen entspricht. Dann zählt man so die Stundenlinien von der ersten an, die in dem Teile des Unterganges den Anfang nimmt, um die vollen Stunden der Sonne zu zeigen oder auch den Bruchteil, wenn der Gegenpunkt der Sonne nicht auf eine Stundenlinie fällt, sondern in den Zwischenraum. Dieses gilt auch für eine Beobachtung am Nachmittag. Dabei ist nur der Unterscheid, dass wir beim Zählen der Parallelkreise bei den Beobachtungen am Vormittag vom Aufgang her den Anfang der Zählung machen, bei denen am Nachmittag aber vom Untergange her. Die Stunden freilich zählen wie immer beim Untergange beginnend, sei es dass die Beobachtung am Tage, sei es dass sie Nachts gemacht war. Davon werden wir nun den Grund angeben.

Weshalb die Stundenlinien in dem Abschnitt eingezeichnet werden, der dem unter der Erde gelegenen entspricht, und weshalb wir den Anfang ihrer Zählung auf den Untergang verlegen, und wie man den Bruchteil der Stunde erhält.

Als PTOLEMAIOS sich des grössten Eifers für Deutlichkeit und Leichtfasslichkeit befleissigte, war er sich bewusst, dass, wenn er die Zeichnung der Stunden auf dem der oberirdischen Halbkugel entsprechenden Teile, auf dem er auch die Zeichnung der Parallelkreise gemacht hatte anbringen würde, er Verwirrung hineinbringen würde in das Instrument und Unhandlichkeit für die Gebraucher in Bezug auf die Unterscheidung, welche Linien Stundenlinien, und welche Parallelkreise bedeuten. Deswegen zeichnete er die Stunden auf den anderen Halbkreis. Da das nun klar ist, dass, wie gross der Teil des Kreises ist, den die Sonne in jedem Zeichen durchläuft so gross auch der Teil, unter der Erde sein wird, den das der Sonne diametral gegenüberliegende Zeichen beschreibt [der 20. Grad des Widders beschreibt über der Erde den gleichen Teil des Kreises, den unter der Erde der 20.

Grad der Wage beschreibt, und bei allen verhält es sich bezüglich des Gegenpunktes ebenso], und dass der Gegenpunkt unter der Erde gerade so weit vom westlichen Horizont absteht, als die Sonne über der Erde vom oestlichen Horizont, so macht es keinen Unterschied im Erkennen der Grösse des Abstandes, den die Sonne vom Aufgange hat, ob man diesen selbst misst oder den des Gegenpunktes unter der Erde vom westlichen Horizont. Dass es das Gleiche ist, ist, wie wir sagten, bewiesen. Da er nun wegen der Verwirrung der Linien die Zeichnung der Stunden auf dem der über der Erde gelegenen Halbkugel entsprechendenden Teile nicht in angenehmer Art machen konnte, und sie deshalb in den gegenüberliegenden Halbkreis verlegte, so nimmt er aus diesem Grunde den Gegenpunkt der Sonne und untersucht, wie weit er unter der Erde vom westlichen Horizont sich fortbewegt hat, und ebenso gross wurde die Bewegung der Sonne über der Erde vom östlichen Horizont aus erkannt. Dies ist nun der Grund, weshalb man den Gegenpunkt der Sonne nimmt, durch den auch vom Untergange her die Zählung der Stunden auf der Hemisphaere unter der Erde geschieht. Damit wir aber auch genau erkennen, wie gross der Bruchteil der Stunde ist, wenn der Gegenpunkt der Sonne nicht auf eine Stundenlinie selbst sondern in den Zwischenraum fällt, so müssen wir den Ort, in den er fällt, mit einem Zeichen versehen, dann auf dieses Zeichen eine mit Tinte angefeuchtete Feder setzen und sie unbewegt in dem auf der Spinne gefundenen Grade festhalten und sie zugleich mit der Spinne bis zu den beiderseits gelegenen Stundenlinien drehen, und die ganze durch die Tinte auf der Scheibe entstandene Linie mit einem Faden, oder dergleichen messen, dann untersuchen, der wievielte Teil der ganzen Linie es ist bis zu dem Punkte, in dem der Gegengrad des beobachteten lag. Auf diese Art wird erkannt der Bruchteil der Stunde.

8125.

Eine andere Methode.

Kunstgerechter ist das Auffinden des Bruchteils der Stunde auf andere Art. Man muss auf einen von den Gradstrichen der Spinne achten, wieviele Parallelkreise und Teile davon er durchläuft in der Zeit, dass der gefundene Grad des Zodiakus den ganzen Zwischenraum zwischen den beiden Stundenlinien, in

dem er liegt, durchläuft, dann muss man wieder oben zusehen, wieviele Parallelkreise und Teile davon dasselbe Gradzeichen durchläuft in der Zeit, dass der Grad den gesuchten Teil der Stunde durchläuft, bis zu dem Zeichen in dem Zwischenraum, in dem er lag, und so findet man das Verhältnis des Teiles zum Ganzen, zum Beispiel, wenn der Gradstrich in Bezug auf den ganzen Abstand der Stundenlinien vier und einen halben Parallelkreis durchläuft (12), dann sage, dass der dritte Teil der Stunde der gesuchte ist. Dies kann auch geschehen auf den Instrumenten bei denen der äussere Umfang der Scheiben oder ihres Behälters in 360 Grad geteilt ist, durch den auf sie haftenden Gradzeiger der Spinne. Wir zählen wieviel Grad der Zeiger in der ganzen betreffenden Stunde durchläuft, dann wieder, wieviel der Zeiger in dem vollendeten Teile der Stunde durchläuft, von dem wir suchen, der wievielte Teil er von der ganzen Stunde ist. Aus dem Verhältnis dieser Grade für die ganze Stunde und der für den Teil werden wir erschen, der wievielte Teil einer ganzen Stunde der gesuchte Teil ist.

Dass auch die vier Spitzen (13), nämlich der Horoskopos, die Mitte des Himmels und die diesen diametral gegenüberliegenden gleichzeitig sichtbar werden, und dass es möglich ist, sie in den Instrumenten auf der betreffenden Scheibe zu erblicken.

Aus eben dieser Lage erhalten wir auch die vier Spitzen, den Horoskopos und die Mitte des Himmels und die diesen Punkten diametral gegenüberliegenden, ich meine den Untergang und die Himmelsmitte unter der Erde. Wenn nämlich der Grad des Zodiakus, in dem die Sonne steht, wie sie jetzt auf dem 20. Grade des Widders steht, dem Parallelkreise aufliegt, in dem sie gefunden wurde, hier dem 30. vom Aufgange an, so muss man nachsehen, welches das aufgehenden Zeichen ist, und der wie-

(12) Hier fehlt die Angabe der Zahl der Parallelkreise für den Teil der Stunde. Aber diese Bestimmungsmethode ist falsch, dagegen ist die folgende richtig.

(13) Ich habe das griechische Wort *κέντρα* mit Spitzen übersetzt, gemeint sind die 4 Hauptpunkte des Astrolabs, die man später cardines oder *anguli* nannte. Bei *Σάβοκκντ* werden sie mit den astrologischen Namen, Leben, Väter, Hochzeit, Himmelsmitte bezeichnet und es wird angedeutet, dass zwischen je zweien noch 2 andere liegen (12 himmlische Häuser). PHILOPONOS hält sich vom Astrologischen frei.

vielte Grad und Teil des Grades an dem Horizonte hattet, und erklären, dass sei der Horoskopos, ebenso muß man zusehen, welches Zeichen untergeht, und welcher seiner Grade dem westlichen Horizonte, d.i. dem äussersten gegen den Untergang gelegenen Parallelkreise, anliegt, und sagen, dies sei die Untergangsspitze. Es ist aber klar, da das dem Aufgehendem diametral gegenüberliegende das Untergehende ist. Ferner ist zu beachten, welches Zeichen und der wievielte seiner Grade es ist, der der dem Meridian entsprechenden Linie auf dem Teile der Scheibe, der der Halbkugel über der Erde entspricht, anhaftet, und hiervon ist zu sagen, es sei die Spitze der Himmelsmitte, ferner den diametral gegenüberliegenden Grad in der Mitte des Himmels unter der Erde, der auf dem anderen Teil unter dem Horizont der Linie, die dem Meridian entspricht anhaftet. Auch das muss man wissen, dass es bei den Astrolabien, in denen der Aussenrand der Scheiben in 360 Grad geteilt ist, keinen Unterschied macht, welcher Scheibe wir das Diopter für die Beobachtung anfügen, wofern sein Zeiger auf die Grade fällt. Die übrigen Teile der Beobachtung müssen wir so machen, wie wir bereits sagten, indem wir die Spinne dem in Frage kommenden Klima auflegen.

Ueber die nächtliche Beobachtung der Fixsterne in kunstgemässer Art.

Soviel nun über die Beobachtung am Tage. Ueber die Beobachtung in der Nacht möchten wir sagen, dass auf der Spinne gewisse helle Fixsterne eingetragen sind, auf dieser 17, auf jener mehr noch, von denen einige durchaus in jeder Nacht und jeder Stunde über der Erde zu sehen sein müssen, wie z.B. der in der Leyer und der Arkturus und die übrigen, die du auf der Spinne eingetragen finden wirst, bei jedem steht das dem eingetragenen Stern eigentümliche Kennzeichen. Man muss nun, wenn man nachts die Stunde erfahren will, einen von den auf der Spinne verzeichneten, über der Erde sichtbaren Stern beobachten. Die Beobachtung geschieht so : Wir erheben das Instrument an dem Gehänge, halten es über unserem Auge und lehnen die in 90 Grad geteilte Seite des Instrumentes an den beobachteten Stern, so dass sie möglichst in derselben Ebene mit dem Stern liegt.

Dann stellen wir das Auge unter das Diopter, bewegen dies langsam hierhin und dorthin, bis des Strahl des Auges durch das Loch des unteren Plättchens auch durch das Loch des oberen Plättchens hindurchgeht, und man durch beide zugleich den Stern erblickt. Hierbei ist die grösste Sorgfalt nötig, damit wir nicht das Auge vorbeiwendend, unbemerkt den Stern ausserhalb des Plättchens sehen und nicht durch sie hindurch, deshalb muss man ein Auge schliessen und nur mit dem anderen beobachten, damit nicht der genannte Irrtum entsteht. Wenn wir nun den Stern beobachtet haben, sehen wir zu, wie weit der Grad, auf den der Zeiger des Diopters fiel, vom Horizont absteht, in gleicher Art, wie es bei der Sonne geschah, und versehen ihn mit einem Zeichen. Dann suchen wir das Klima, in dem wir uns bei der Beobachtung befanden, und bezeichnen auf ihm den dem beobachteten Grad gleichgeordneten und gleichzahligen Parallelkreis wieder mit Tinte. Wenn nun der beobachtete Stern etwa in dem Quadranten vor dem Meridian war, so muss man den Parallelkreis vom Aufgange an bezeichnen, wenn aber nach den Meridian, vom Untergange an, ähnlich wie es bei der Sonne geschah. Dann legen wir die Spinne auf das Klima, in dem wir beobachteten, und suchen auf ihr den beobachteten Stern, gesetzt es sei Wega oder Spika oder ein anderer, und drehen die Spinne so, dass das Zeichen dieses Sternes dem Parallelkreise anhaftet, in dem wir den Stern beobachteten, und den wir bezeichnet hatten. Dann nehmen wir den Grad, in dem damals die Sonne war aus den Ephemeriden, oder nach einer Methode, die wir bald lernen werden, daraus werden wir finden, dass er in dem Halbkreis der Scheibe liegt, in dem die Stundenlinien eingezeichnet sind. Wir werden ihn nun mit Tinte bezeichnen und die Stunden vom Untergang an zählen, und das übrige tun wir wie bei der Sonne. So werden wir die vollendeten Nachtstunden und auch, wenn es sich trifft, den Bruchteil finden. Auf dieselbe Art werden wir die vier Spitzen auf ihrem ihnen zukommenden Ort liegend sehen.

Wie man erkennen soll, ob die Sonne oder jeder einzelne Fixstern vor, in oder nach dem Meridian gesehen wird, und wie man die grösste Höhe für jeden Grad des Zodiacus findet.

•••
Wenn nun der beobachtete Stern oder die Sonne sehr weit

vor oder nach dem Meridian stand, ist aus der Beobachtung leicht zu unterscheiden, welche Abschnitte der Parallelkreise wir gebrauchen werden, ob die vor- oder die nachmittägigen. Wenn er aber nicht weit nach dem oestlichen oder westlichen Horizont hinneigt, dann wird es zweifelhaft, ob der angeschaute Stern oder die Sonne vor oder nach dem Meridian steht. Wenn er dem Meridian sehr nahe wäre, wird es nicht zu erkennen sein, ob er vor oder nach dem Meridian steht. Wir unterscheiden deshalb auch noch diese Lage. Wenn wir die Sonne beobachten, müssen wir untersuchen, bis zu welcher höchsten Höhe, sie sich an jenem Tage erhebt, an dem wir beobachteten. Um dies zu erkennen, müssen wir das Zeichen und den Grad, in dem an jenem Tage die Sonne ist, wie in unserem Beispiel den 20. Grad des Widders, nehmen und diesen Grad auf der Spinne mit Tinte bezeichnen, diese dann drehen, bis der Grad die Linie des Mittags berührt, dann sehen dem wievielten Parallelkreis er sich anpasst. Und das sagen wir, sei die grösste Höhe der Sonne über der Erde, wenn sie im 20. Grade des Widders steht. Wenn nun darauf die beobachtete Sonne auf diesem Grade, ich meine dem der grössten Höhe gefunden wird, so steht sie offenbar gerade im Meridian, wenn sie aber in kleinerer Höhe gesehen wird, so wird sie vor oder nach dem Meridian sich befinden. Um dies zu erkennen warten wir ein wenig und beobachten noch einmal, und wenn wir dann finden, dass die Zahl der Grade grösser geworden ist, dann ist klar, dass das, was wir zuerst beobachteten, vor dem Meridian war. Und auf andere Art : wenn wir bei Beobachtung der Sonne finden, dass sie z.B. 70 Grad über den Horizont sich erhebt, und wenn wir dann nicht in der Lage wären, aus der Beobachtung zu unterscheiden, ob es vor oder nachmittags ist, dann müssen wir gleichfalls kurze Zeit warten und von neuem beobachten, und wenn die Höhe vorgeschritten und etwa 71 Grad geworden ist, dann ist es ganz klar, dass die Sonne bei der ersten Beobachtung vor dem Meridian stand, wenn sie aber abgenommen hat und etwa 69 Grad geworden ist, dann ist es wiederum klar, dass die Beobachtung nach dem Meridian gemacht wurde. Damit wir nun dies erkennen, müssen wir vom Untergange an die Parallelkreise zählen, um die sie zuerst über den Horizont erhoben beobachtet war, wie sie jetzt auf dem 70. liegt, dann von der Spinne den Grad des Zeichens in dem damals die Sonne war,

dem beobachteten Parallelkreise anpassen, wie jetzt dem 70. vom Untergange an. Wenn sie nun im Meridian selbst beobachtet worden wäre, so ist es klar, dass der Grad der Sonne auf die Linie fallen wird, die dem Meridian entspricht und die Parallelkreise schneidet, wenn aber nach dem Meridian, so wird er nach dem Untergange hin verschoben. Soviel nun über die Sonne. Bei den Sternen handeln wir wieder auf dieselbe Art, wir fragen nach der grössten Höhe, die ein Stern in dem Klima, in dem er beobachtet wurde, erreicht. Dies aber erfahren wir so, wir passen sein Kennzeichen der Graden an, die dem Meridian entspricht und sehen zu, dem wievielten Parallelkreis es sich anpasst, wenn wir es auf die Linie des Meridians gebracht haben. Das ist dann seine grösste Höhe in seinem Klima, und das übrige thun wir so, wie wir auseinander gesetzt haben, dass es bei der Sonne geschieht. Auch die zweite Methode lässt sich jetzt anwenden. Man muss wieder kurze Zeit vorbeigehen lassen, dann beobachten und das übrige auf die gleiche Weise thun. Wenn wir nun wider nach kurzer Zeit den Stern beobachten und die Zahl der Grade kleiner finden, fügen wir das Zeichen des beobachteten Sternes der Zahl der Parallelkreise an, in welcher wir ihn bei der ersten Beobachtung angetroffen haben (die Zählung der Parallelkreise beim Untergange beginnend), wenn wir finden, dass das Zeichen des Sternes auf die dem Meridian entsprechende Linie fällt, so sagen wir dass er im Meridian selbst gesehen wurde, wenn er aber gegen den Untergang abweicht, so liegt er nach dem Meridian. Nach dem Gesagten ist klar, was zu thun ist um die grösste Höhe eines Grades eines Tierkreiszeichens für jedes Klima zu erhalten. Man muss nämlich die Spinne auf die Scheibe des betreffenden Klimas legen, dann jenen Grad, dessen Höhe wir erfahren wollen, herum drehen, bis er die Linie des Mittags berührt, und ebenda werden wir die eingeschriebene Gradhöhe finden. So nun sind wir imstande, die Höhe eines jeden Grades zu finden. Dies ist das Erkennen der Mittagslage für jedes Klima.

Wie man findet, in wieviel Aequinoctialzeiten jedes Tierkreiszeichen aufgeht, und in wievielen es untergeht.

• Noch eine andere Anwendung des Instrumentes fügen wir hinzu. Wir werden nämlich daraus erfahren, in wieviel Aequinoctial-

zeiten für jedes Klima ein jedes Tierkreiszeichen aus dem oestlichen Horizonte über die Erde erhoben wird, und in wievielen wiederum es untergeht. Zuerst muss man wissen, dass dem Teile des Instrumentes, in den die Scheiben eingelegt werden, auf den die Spinne gelegt wird, den man auch den Behälter der Scheiben zu nennen pflegt, ein Ring aufliegt, der, wie ich schon früher sagte, in 360 Teile geteilt ist, die den Teilen des Aequators entsprechen, und die man auch aequinoctiale Zeiten (14) nennt. Ist das ganze Instrument zusammengefügt, so wird der darauf befindliche Ring mit der Ebene der zu oberst liegenden Scheibe zusammen fallen, so dass das Ganze eine einzige Ebene bildet. In den eingradigen Instrumenten, bei denen meistens kein Behältnis vorhanden ist, sondern jede Scheibe selbst für sich wegen ihrer Grösse geteilt ist und nicht einer anderen aufliegt, ist überhaupt der besprochene Ring nicht vorhanden. An der Grenze jeder Scheibe, d. h. an ihrem Umfange, sind die genannten 360 Zeitteile eingraviert, auf sie fällt auch der Zeiger der Spinne.

Ein Beispiel.

Gesetzt nun wir suchen in wievielen aequinoctialen Zeiten beispielsweise der Skorpion im 3. Klima aufgeht, so müssen wir auf dieses Klima die Spinne legen, dann den ersten Grad des Skorpions dem vom Aufgange an ersten Parallelkreise anlegen, dann suchen wir, welchem Grade des genannten, in 360 Teile, die auch aequinoctiale Zeiten genannt werden, geteilten Kreises sich die am Rande der Spinne befindliche Marke, sie liegt in der Mitte ihres Aussenkreises, anfügt, und diesen merken wir an; dann drehen wir die Spinne bis der letzte Grad des Skorpions, d. i. der 30. in die Höhe kommt und sich dem ersten oestlichen Parallelkreise anlegt, dann suchen wir wieder, welchem Grade des Kreises sich die genannte Marke anfügt und merken auch diese an, dann zählen wir alle Grade von dem zuerst angemarkten bis zu dem letzten, und wieviele von den 360 Grad wir finden, die die Marke während des ganzen Aufganges des Skorpions durchlaufen hat, in sovielen aequinoctialen Zeiten behaupten

(14) χρόνος bedeutet hier Zeitgrad, d. i. 4 Minuten einer aequinoctialen Stunde. Die Bedeutung der Wörter χρόνος und μοῖρα gibt PTOLEMAIOS in Ὑποθέσεων τῶν πλανωμένων I. 3.

wir, dass der Skorpion aufgeht. Das gleiche gilt für jedes der übrigen Zeichen. So nun werden wir finden, in wieviel aequinoctialen Zeiten ein jedes Zeichen in jedem Klima aufgeht. Auf dieselbe Art werden wir auch finden, in wieviel aequinoctialen Zeiten ein jedes untergeht, indem wir den ersten Grad des fraglichen Zeichens dem letzten westlichen Parallel anfügen und den Grad, in welchen die Marke am Rande der Spinne fällt, anmerken, dann wieder drehen und den 30. Grad des Zeichens auf den westlichen Horizont setzen, d. h. auf den letzten Parallelkreis, dann wieder zusehen, wohin die Marke der Spinne fällt, und zählen wieviele aequinoctiale Zeiten sie während des ganzen Unterganges des Zeichens durchlaufen hat. In sovielen Zeiten werden wir sagen, sei das Zeichen unter die Erde hinabgekommen.

Wie wir finden, wieviel aequinoctiale Zeit auf die temporäre Stunde eines jeden Tages und einer jeden Nacht geht.

Durch dieselbe Methode kann man auch finden, aus wievielen aequinoctialen Zeiten jeder temporärer Tag (15) und jede Stunde besteht. Um dies zu finden müssen wir den Grad nehmen, in dem die Sonne ist, und ihn dem ersten oestlichen Parallel anlegen, dann den Grad anmerken, auf den die Marke der Spinne fällt, dann die Spinne herumdrehen, bis der Grad der Sonne in den letzten, gegen den Untergang gelegenen Parallel kommt, d. h. bis die Sonne die ganze Halbkugel über der Erde durchlaufen hat, darauf muss man wieder den Grad anmerken, auf den die Marke der Spinne fiel, dann die Grade zählen, beginnend bei dem zuerst angemerkten bis zu dem letzten und behaupten, soviel aequinoctiale Zeiten habe der vorliegende Tag. Diese teilen wir durch 12 und sagen, wieviele aequinoctiale Zeiten oder Teile davon die temporäre Stunde hat. Auf gleiche Art werden wir eine gegebene temporäre Nacht und die Grösse ihrer temporären Stunden finden, indem wir den Grad der Sonne auf den westlichen Horizont, der in dem äussersten Parallel liegt, setzen und anmerken, mit welchem Grade des äusseren Umfanges des Instrumentes die Marke der Spinne zusammenfällt, dann

(15) *ἡμέρα καυική*, dies temporalis, die Zeit von Sonnenaufgang bis Sonnenuntergang.

drehen wir die Spinne, bis der Grad der Sonne nach Durchlaufen des Theiles der Scheibe, der dem unter der Erde Befindlichen entspricht, den oestlichen Horizont berührt, d.i. den letzten Parallel nach dem Aufgange hin. Hierauf bezeichnen wir wieder den Grad, dem die Marke der Spinne anhaftet, dann zählen wir alle Grade von dem zu Anfang angemerkten an, und behaupten, soviele aequinoctiale Zeiten habe die vorliegende temporäre Nacht. Und teilen wir diese durch 12, so finden wir auch wieviele aequinoctiale Zeiten die Nachtstunde hat. Hieraus hast du nun auch den Unterschied der temporären Stunden gegen die aequinoctialen.

Wie durch das Instrument der Stand der Sonne zu finden ist, und wie mit ihm die für jeden Tag höchste Höhe der Sonne zu bestimmen ist.

Auch der Stand der Sonne kann ohne Tabelle durch den Gebrauch des Instrumentes auf folgende Art gefunden werden. Man nehme die grösste Höhe der Sonne über der Erde an dem betreffenden Tage, wir nehmen sie aber durch Beobachtung der Sonne am Mittag. Offenbar aber muss man öfters beobachten, bis sie nicht mehr in die Höhe steigt, sondern die grösste Höhe erreicht hat und beginnt niedriger zu werden und der Erde näher zu kommen, denn es ist einleuchtend, dass der Punkt, von dem an sie wieder niedriger wird, ihre grösste Höhe ist. Nehmen wir nun diese, dann sehen wir zu, welchen Quadranten die Sonne durchläuft, ob den vom Frühlings- oder den vom Herbstaequinoctium, oder den von der Sommer- oder den von der Winterwende an, dies aber ist überall bekannt, denn auch der Anfang der Zeiten sowohl der Aequinoctien wie auch der Wenden ist allen bekannt. Wir nehmen diesen Quadranten des Zodiacus auf der Spinne und legen sie auf das Klima, in dem wir beobachten und passen jeden Grad des Quadranten, in dem zur Zeit die Sonne ist, dem Meridian an, und suchen, wer von ihnen soviele Parallele gehoben wird, wenn er in den Meridian kommt, wieviele an jenem Tage die Sonne gehoben gefunden wurde, und den erklären wir, habe die Sonne zur Zeit inne. Dies geschieht, wenn die Sonne nicht nahe bei den Wenden steht, sondern weit von ihnen entfernt ist. Wenn sie aber nahe dabei ist, bedarf es einer anderen Unterscheidung, die wir lehren werden.

Welche Grade des Tierkreises unter denselben Parallelen sind und zur gleichen Höhe sich erheben, und wie man findet, in welchem Quadranten des Tierkreises die Sonne steht, wenn sie sich nahe bei den Wenden befindet.

Keiner von den Graden in demselben Quadranten erreicht mit einem anderen die gleiche Höhe. In dem ganzen Tierkreise wirst du um die Zeichen der Wenden herum nur bei zweien dieselbe Höhe finden, es sind die, welche auf demselben Parallel liegen. Auf demselben Parallel aber sind die, die um die gleiche Entfernung abstehen von den Zeichen der Wenden, von jeder von beiden für sich, ich meine der Sommerwende und der Winterwende, die im eigentlichen Sinne Wenden sind, denn von ihnen wendet sich die Sonne nach den nördlichen oder nach den südlichen Zeichen. Von dem Steinbock nämlich beginnt sie nach Norden zu steigen bis zum Krebs, von diesem wieder beginnt sie zurückzugehen und nach Süden hinabzusteigen bis zum Steinbock. Freilich nennen auch manche die Zeichen der Tagundnachtgleichen tropische, und die meisten sagen, es gebe vier Wenden wegen des Wechsels der Stunden. Doch nur zwei Punkte sind im eigentlichen Sinne tropische, nämlich der erste Grad des Krebses und der erste Grad des Steinbocks. Ueber diese braucht man nicht genau zu reden, da sie keinen anderen gleichgestellt sind, denn kein Grad des Tierkreises erreicht mit ihnen die gleiche Höhe, sie sind ja die Endpunkte der Schiefe selbst, daher sind sie auch nicht auf demselben Parallel, weder mit einander noch mit irgendeinem Grade des Tierkreises, die aber nach beiden Seiten gleichen Abstand von ihnen haben, sind auf einem und denselben Parallel und erreichen deswegen dieselbe Höhe über der Erde. So stehen nach beiden Seiten vom Anfang des Krebses gleich weit ab der Anfang des Löwen und der Anfang der Zwillinge, denn es sind 30 Grad nach jeder Seite. Diese 2 Grade nun, der Anfang des Löwen wie auch der Anfang der Zwillinge sind auf demselben Parallel und erreichen deswegen dieselbe grösste Höhe über der Erde. Damit das Gesagte klar wird bringe man auf die beiden Grenzen der Halbkugel über der Erde die beiden Tagundnachtgleichenzeichen, alsq etwa auf die oestliche den Anfang der Wage (16), auf die westliche den

(16) Das Sternbild der Wage heisst hier *ζυγός*, bei *PTOLEMAIOS* kommt nur die ältere Bezeichnung *χηλαί* vor.

Anfang des Widders. Diese, nun wirst du sehen, haben einen und denselben Parallel inne, den ersten durch den der Teil der Scheibe, der der Halbkugel über der Erde entspricht, getrennt wird von dem unter der Erde. In dieser Lage wirst du auch den ersten Grad des Krebses und den ersten Grad des Steinbocks auf die Mittagslinie fallen sehen. Da die Aequinoctialpunkte gleichen Abstand haben vom Sonnenwendepunkte, ich meine vom ersten Grade des Krebses, so sind sie auch sozusagen auf demselben Parallel und erreichen dieselbe Höhe über der Erde. In gleicher Art wirst du die übrigen Grade, die von beiden Seiten des Krebses gleichen Abstand haben, demselben Parallel anhaften und dieselbe grösste Höhe erreichen sehen. Gerade dies wirst du auch bei denen sehen, die von den zwei Punkten der Gleichen denselben Abstand haben, denn Punkte die von einer der Wendungen gleich weit abstehen, haben auch gleichen Abstand von den beiden Gleichen, jeder von einer anderen, nämlich von der einen im Vorangehen, von der anderen im Nachfolgen. Z. B. um wieviel absteht der Anfang der Zwillinge vom Anfange des Krebses, um soviel steht auch der Anfang des Löwen vom Anfange des Krebses ab, da ja der Anfang des Löwen im Vorangehen gleich weit vom Anfange der Wage absteht, wie der Anfang der Zwillinge im Nachfolgen vom Anfange des Widders. Aber nicht, weil sie von den Gleichen denselben Abstand hatten, sind sie auf demselben Parallel, sondern weil sie von den Wendungen gleichen Abstand hatten. So haben gleichen Abstand vom Anfange des Widders der Anfang der Fische und der Anfang des Stieres, aber sie sind weder auf demselben Parallel, noch erreichen sie die gleiche grösste Höhe, die Fische nämlich sind südlicher, der Stier aber ist nördlicher. Aber wahrlich, wie weit im Nachfolgen vom Anfange des Widders der Anfang der Fische absteht, ebenso weit steht im Nachfolgen der Anfang der Jungfrau vom Anfange der Wage, aber sie sind nicht auf gleichem Parallel, da ja die Jungfrau nördlich ist, und die Fische südlich. Da nun die von einem der Wendepunkte gleichweit abstehenden Punkte auf demselben Parallel liegen, die beiden Gleichen aber von den Wendungen gleichen Abstand haben, und auf demselben Parallel sind, so sind die Punkte, die von jedem der Gleichen denselben Abstand haben, der eine von diesem, der eine von dem anderen, der eine in der Folge der Zeichen, der andere gegen die Zeichen-

folge auf demselben Parallel. Es macht keinen Unterschied, wenn du auch den Anfang des Widders auf den oestlichen und den Anfang den Wage auf den westlichen Horizont stellen möchtest, wobei dann offenbar der Anfang des Steinbocks auf die Mitte des Himmels fiele, denn du würdest dasselbe wieder eintreffen sehen. Nun gibst es nur zwei Punkte zu beiden Seiten der Wenden, die gleiche Höhe erreichen. Wenn wir nun den Ort der Sonne suchen, während sie in der Nähe der Wendepunkte sich befindet, so wird es schwer zu unterscheiden sein, in welchem Quadranten sie gerade ist, wegen der gleichen Höhe, die Punkte in gleichem Abstände von den Wendepunkten erreichen. Es betrage z. B. die Höhe vom Anfange des Krebses 90 Grad, die der beiderseits 10 Grad von ihm abstehenden, d. h. des 10. Grades des Krebses und des 20. Grades der Zwillinge 87, wenn nun die Sonne am 20. Grade der Zwillinge oder am 10. Grade des Krebses steht, und wir den Ort der Sonne suchen, dann nehmen wir ihre grösste Höhe, die nach der Voraussetzung 87 Grad ausmacht und suchen, welcher Grad in den Quadranten der Spinne diese grösste Höhe erreicht und wir finden dass sowohl der 10. Grad des Krebses, als auch der 20. der Zwillinge diese grösste Höhe erreicht. Nun sind wir nicht im stande aus der Wahrnehmung zu unterscheiden, ob die Sonne vor der Sommerwende im 20. Grade der Zwillinge, oder nach der Sommerwende im 10. Grade des Krebses steht, denn dasselbe trifft auch hier zu, wie es ja zutraf, als wir die Sonne um den Meridian beobachteten. Dies nun kommt vor, wenn wir lange Zeit in der Einsamkeit zugebracht haben und vom Monat gar nichts wissen, oder bei einem Volke, dass die Monate nicht nach unserer Art, oder ganz und gar nicht zählt. Wir lassen dann einen oder zwei Tage vorbeigehen und beobachten in gleicher Art, wenn wir dann finden, dass die Sonne an Höhe zugenommen hat, so ist es offenbar, dass sie bei der ersten Beobachtung vor der Sommerwende war, wenn sie aber abgenommen hat, so war sie nach der Sommerwende. Und so ist es nun auch, wenn die Sonne nahe wäre der Sommerwende oder der Winterwende. Wenn freilich die Sonne weit abstände von der Sommerwende oder der Winterwende, nach der einen oder anderen Seite, bleibt demnach nur der eine Zweifel, in welchem Quadranten wir den Grad suchen müssen, der dieselbe grösste Höhe hat, unter der von uns die Sonne beobachtet

war. Wenn nämlich die Untersuchung vor der Sommerwende gemacht wäre, dann muss man suchen, welcher von den Graden vom Widder an bis zum 30. der Zwillinge d. i. bis zum ersten des Krebses dieselbe grösste Höhe über den Horizont erreicht, unter der damals die Sonne gesehen wurde, wenn aber nach der Sommerwende beobachtet wurde, dann ist zu suchen vom Anfange des Krebses bis zum 30. Grad der Jungfrau, d. i. bis zum Anfang der Wage. In gleicher Art ist zu verfahren, wenn es vor der Winterwende war, vom Anfang der Wage bis zum 30. Grad des Schützen, d. i. dem Anfang des Steinbocks, wenn es aber nach der Winterwende war, vom Anfange des Steinbocks bis zum 30. der Fische, d. i. dem Anfange des Widders.

Wie man den Ort jedes einzelnen Planeten findet.

Es ist nun auch der Ort der übrigen Planeten durch das Instrument zu erkunden, ganz genau, wenn sie in der Mittellinie des Tierkreises stehen, weniger genau, wenn sie davon abweichen, auf diese Art. Zuerst muss man einen von den der Spinne eingeordneten Fixsternen nach der schon angegebenen Methode beobachten und wenn wir dann erfahren haben, um wieviele Parallelen er über dem oestlichen oder westlichen Horizont erhoben ist, die Spinne auf das Klima, in dem wir beobachten legen, entsprechend der Lage des Alls, d. i. die Marke des beobachteten Fixsternes dem Parallel, auf dem er gesehen wurde anpassen. Dann müssen wir wiederum den fraglichen Planeten beobachten und anmerken, wieviel Parallelen er über dem weslichen oder oestlichen Horizont erhoben ist und im vorliegenden Klima den gleichzahligen Parallel suchen und von ihm den Teil, der entweder nach dem Untergange oder nach dem Aufgange hin liegt, in dem der Planet angetroffen war. Dann suchen wir mit welchem Grad des Tierkreises dieser Teil des Parallels zusammenfällt und behaupten, diesen Ort habe der damals beobachtete Planet inne. Da die Sonne sich immer in der Ekliptik bewegt trifft es natürlich zu, dass wir den Ort des Planeten durch die Beobachtung ganz genau finden, so oft er auf der Linie sich bewegt, auf der wir auch die Oerter der Sterne (17) feststellen.

(17) Das bei HASE im Text stehende χρόνων wurde von TANNERY in ἀστέρων verbessert.

In den übrigen Fällen, da die Planeten sich nicht immer auf dieser Linie bewegen, sondern oft gegen sie eine schiefe Bewegung machen, so dass sie bald nördlicher bald südlicher werden, geschieht es, wenn wir sie von dieser Linie abweichend beobachten, wenn wir die vom Auge aus auf sie gerichtete Grade gegen den Tierkreis herausrücken, dass sie nicht auf die Ekliptik selbst fallen, sondern ausserhalb entweder mehr nach Norden oder mehr nach Süden, und dass wir deshalb ihren Ort nicht ganz genau ermitteln, da ja, wie ich sagte, nur nach der Ekliptik die Festsetzung der Oerter getroffen wird.

Wie man findet, wie weit jeder Grad des Tierkreises und ebenso die Sonne, der Mond und jeder der Planeten nach Norden oder nach Süden vom Aequator absteht. •

Wir werden durch den Gebrauch des Instrumentes auch ermitteln, wie weit jeder Grad des Tierkreises der Breite nach vom Aequator nach Norden oder Süden absteht, auf folgende Art. Es ist uns im Vorhergehenden gesagt worden, dass der Abstand zwischen der Winterwende und der Sommerwende die ganze Schiefe des Tierkreises bestimmt, die 48 Grad beträgt. Von dem Sommerwendekreise nämlich bis zum Aequator sind es 24 Grad, von dem Aequator bis zum Winterwendekreise die übrigen 24 Grad. Es ist nun klar, dass die Sonne, während sie den ganzen Halbkreis von der Winterwende bis zur Sommerwende durchläuft, nach Norden hin aufsteigt, umgekehrt aber von der Sommerwende bis zur Winterwende nach Süden hin niedriger wird. Offenbar aber liegt der Aequator zwischen dem Winterwendekreise und dem Sommerwendekreise, weshalb zweimal im Jahre sich die Sonne in ihm befindet, wenn sie von der Sommerwende nach der Winterwende gekommen ist, in der Wage, wenn sie aber von der Winterwende zur Sommerwende gekommen ist, im Widder, so dass die Sonne in bezug auf jeden Halbkreis bald nördlich bald südlich vom Aequator steht. Wenn wir nun wissen möchten, wie weit jeder Grad des Tierkreises auf beiden Halbkreisen vom Aequator nach Norden oder nach Süden absteht, so werden wir es auf folgende Art finden.

• Von den Tagnachtgleichenzeichen muss man den Anfang des Widders oder der Wage der Mittagslinie über der Erde an-

passen und merken, auf welchen Parallel er fällt, dann wieder den fraglichen Grad des Tierkreises derselben Mittagslinie anpassen, und merken auf welchen Parallel er fällt. Ist das geschehen, dann behaupten wir jener Grad steht soweit vom Aequator ab, als wir Parallelkreise von dem des Aequators bis zu dem jenes Grades finden, ob aber das Gesuchte nach Norden oder nach Süden abweicht, erfahren wir aus dem Anblick selbst, denn wenn der fragliche Grad ausserhalb des Aequators fällt, wie nach der Winterwende hin, wie sie auf der Scheibe eingraviert ist, dann ist es offenbar, dass er nach Süden vom Aequator absteht, liegt er aber innerhalb des Aequators, wie nach der Sommerwende hin, von der wir sagen, dass sie vom Aequator umfasst wird, dann weicht offenbar der fragliche Grad des Tierkreises nach Norden ab. Das ergibt sich aber auch allein aus der Lage der Tierkreiszeichen. Wenn wir nämlich die vom Anfange des Widders bis zum 29. Grade der Jungfrau (18) untersuchen, so ist es klar, dass sie nach Norden hin vom Aequator abweichen, wenn aber die vom Anfange der Wage bis zum 29. Grade der Fische, so werden sie die Abweichung vom Aequator nach Süden haben. Jedem ist es klar, wie wir von hier aus jederzeit ermitteln, wie weit die Sonne der Mond und jeder Planet entweder nach Süden oder nach Norden vom Aequator abweichen, indem wir sie gemäss jedem eingenommenen Grad des Tierkreises behandeln. Denn, wenn wir den Grad, den die Sonne der Mond oder Planet inne hat, nehmen und alles vorhin gesagte ausführen, werden wir das Gesuchte finden. So weit nämlich der Grad des Tierkreises nach Norden oder Süden abweicht, eine so grosse Abweichung wird auch der Stern auf ihm haben. Durch Anwendung derselben Methode werden wir auch erfahren, wie weit südlicher oder nördlicher als der Aequator jeder auf der Spinne verzeichnete Fixstern ist, und wieviel Gerade er nach der einen oder anderen Seite von ihm absteht. *Ende.*

Dorsten, Westfalen.

J. DRECKER.

(18) Im Text steht unrichtig Steinboek.

A Thirteenth Century Algorithm in French Verse

INTRODUCTION.

Among the treatises introducing into Europe the Hindu art of reckoning, those in the language of the people, as opposed to those in Latin, have a particular interest as beginnings in popular education. Not many are known. In a study (1) of early algorisms made by Dr. SUSAN BENEDICT, out of some thirty algorisms which appeared in Europe before the invention of printing there are three in Hebrew, one in German, one in Icelandic, one in French, and two in English, of which one is only a brief extract on numeration.

Recently the English algorism mentioned by Dr. BENEDICT and another algorism have been published by ROBERT STEELE (2) and prove to be respectively a commentary on the *Carmen de Algorismo* of ALEXANDER DE VILLA DEI and a translation of SACRO-BOSCO's *Algorismus Vulgaris*, the two most widely used algorisms of the thirteenth century.

The one French algorism hitherto available was first published by CH. HENRY (3) and later by VICTOR MORTET (4). It is an incomplete treatise too brief to be useful in teaching the new arithmetic.

The present treatise, one of the earliest in any vernacular, to which my attention was called by Dr. HERBERT CRASTER of

(1) *A Comparative Study of the Early Treatises Introducing into Europe the Hindu Art of Reckoning*. Thesis, University of Michigan, 1914. Printed at the Rumford Press, Concord, N. H.

(2) *The Earliest Arithmetics in English*, edited with Introduction by ROBERT STEELE, London, 1922, Early English Text Society, Extra Series, 118.

(3) Boncompagni's *Bullettino di bibl. e di storia delle Scienze matem. e fisiche*, 15, 53.

(4) *Le plus ancien traité français d'algorisme*, *Bibl. Math.*, 3d series, 9, pp. 55-64.

the Bodleian Library, is of real importance from both the philological and the scientific point of view. It does not follow any of the known treatises. In many respects there is closest similarity to the *Carmen de Algorismo* of VILLA DEI. However, in many parts SACROBOSCO's treatise is followed, while several points correspond to the text of the thirteenth century Codex in the Salem Cloister which was transcribed by MORITZ CANTOR (5).

The section in this algorism on multiplication contains in lines 382 to 424 two rules for the learning of the multiplication table between 5 times 5 and 10 times 10 which are not found together in any of the early treatises. According to the first rule, to multiply a digit by itself, subtract from the digit the difference between the given digit and ten, this remainder is multiplied by 10 and to the result is added the square of the difference mentioned.

$$d^2 = 10 [d - (10-d)] + (10-d)^2$$

According to the second rule, to multiply one digit by another, subtract the difference between ten and the lesser digit from the greater digit; multiply by 10; to this add the product of the two differences.

$$a.b = 10 [a - (10-b)] + (10-a)(10-b).$$

This first rule is in fact a special case of the second. This general rule appears in the Salem Codex with the same square of eight as an illustration. The rule appears again in the twelfth century Algorism by Frater SIGSBOTO of the Cloister Prüfning at Regensburg, published by CURTZE (6), and also in the Egerton Manuscript 2261 in which there is a twelfth century (or early thirteenth) Latin algorism (7). N. O'CREAT (8) gives the rule for the square, but not the general rule, as an illustration of the rules ascribed to NICOMACHUS, $a^2 = (a-b)(a+b) + b^2$.

The only numerical illustrations given in the French algorism consist of the applications of these rules to 8 times 8, and to 8 times 7.

Another peculiarity, not so clearly found in other algorisms, is the explanation of the forms of the digits (vv. 101-110).

(5) *Zeitschrift für Math. und Physik*, 10, 1-16.

(6) *Abhandlungen zur Geschichte der Math.*, 8, 1-27.

(7) See KARBINSKI, Two Twelfth Century Algorisms, *Isis*, 3, 396-413.

(8) In *Abhandl. zur Geschichte der Math.*, 2, 131-139, article by CH. HENRY.

Ten lines from this French algorism are quoted by J. O. HALLIWELL in connection with the *Carmen de Algorismo* (9).

As a whole the character of the treatise indicates that it was based upon one or several of the Latin treatises extant in the thirteenth century though it is possible that the authors had before them some early treatise which has not survived. The operations are of the earliest type, before the development of improved methods. It has not been found possible to identify the 'two clerks' who mention themselves in v. 1 as the authors of the poem.

(University of Michigan).

LOUIS C. KARPINSKI.

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THE MANUSCRIPT. The versified Old French algorism here edited for the first time is contained in Ms. Selden Supra 26 (no. 3414 in the Summary Catalogue) of the Bodleian Library, Oxford. This volume is a collection of seven unconnected arithmetical and astronomical treatises, written on parchment by various hands in the late twelfth and the thirteenth centuries, probably in France. The French treatise is placed second, occupying folios 13-16; the remainder of the volume is in Latin, except for some French miscellanea on fo. 23. The size of the French manuscript is 18.8 by 12.5 cm.; the handwriting dates from the thirteenth century. Apart from the first seven lines, which are written as prose, and occasional overflows and insertions in the remainder of the text, it is written in columns of verse, two columns to a page, 34 to 37 lines to a column. The total number of verses preserved is 512; in the edition this has been increased to 519, owing to the necessity of allowing for verses to complete defective couplets. Fo. 16^v contains only four lines of writing, the remainder of the page being left blank. In the first column of fo. 13^r there are two large ornamented initials, L (v. 1) and S (v. 33), overlapping three and two lines respectively, both blue with red vignettes, and connected along the left margin by a series of red and blue strokes with flourishes; this is the only ornamentation.

CONTENTS. The treatise may conveniently be divided into twelve sections, viz. :

(9) *Rara Mathematica*, London, 1839 and 1841, p. 74, note.

I	a general introduction, explaining the necessity of learning arithmetic	(vv. 1-32)
II	on the place of arithmetic among the arts	(33-76)
III	on the origin of arithmetic, its subdivisions, the figures and their use	(77-146)
IV	progression, i. e. the writing of numbers	(147-180)
V	addition	(181-221)
VI	subtraction	(222-273)
VII	duplation	(274-305)
VIII	mediation	(306-327)
IX	multiplication	(328-381)
X	the inter-multiplication of digits	(382-425)
XI	division	(426-458)
XII	square root	(459-519).

The beginning of section II is indicated by a large initial; that of sections IV to IX, XI and XII by a paragraph sign in the margin. The first and the last three of these signs were written by the copyist or his corrector (see below); the remainder are probably by a different hand, which has also added rubrics to the left or right of vv. 181 (*Addicion*), 222 (*Sustracions*), 274 (*Duplaciuns*) and 306 (*Mediaciuns*).

THE SCRIBES. The condition of the text is in many ways unsatisfactory. The copyist did his work hastily and carelessly, apparently making little effort to understand what he was writing. It is clear that vv. 110, 173, 191, 319, 320, 327 and 424-5 (one line) have been omitted, the couplet as well as the sense being incomplete in each instance. There are certainly lacunae after vv. 336 and 339, while the passage 496-501 is entirely incoherent as it stands. Many other omissions may be suspected, but we have no means of judging their extent. In other instances it has been necessary to add words or letters to the text (all indicated by square brackets) in order to make it intelligible. Characteristic examples of the scribe's heedlessness and ignorance will be found in vv. 68, 102, 108, 157, 203, 206, 239, and many other lines. Fortunately a large number of his blunders can be rectified. A second writer, apparently contemporary with the first, has gone through the text and made corrections, in a manner which suggests that he was a master correcting the work of a careless pupil. Seeing that in nearly every instance the alterations improve

the grammar, regularize the metre, and give the sense required by the context, we may conclude that they are based on good authority — probably on a more careful reading of the manuscript which the first scribe was so inaccurately copying. That many of the corrections are by a different hand (possibly two hands) is clear from differences in the colour of the ink used (sometimes darker, more often lighter) and in the formation of letters. Various methods have been employed for making the corrections: words and letters have been expuncted, one letter written upon another, words or parts of words rewritten either above or (rarely) below the line, interlinear and marginal insertions added, etc. Sometimes the reading of the first scribe has not been expuncted or barred, but a second reading added above or beside it. Vv. 267, 268, 273 and 403 have been entirely rewritten, while vv. 224, 252, 396 and 397, all omitted by the first scribe, have been added in the margin. The necessity of disentangling these corrections, many of which could not be properly interpreted without a close scrutiny of the manuscript, has not lightened the task of editing the text; but their presence is a piece of good fortune, without which an edition worthy of publication could not have been produced. As it is, the corrector's attentiveness diminished towards the end of the text, with the result that certain portions of sections VIII-XII are obviously defective or barely intelligible. Only in vv. 7, 166, 284, 336, and perhaps 109, are there good grounds for rejecting readings introduced by the second writer. Alterations of all kinds found in the Ms., including corrections by the first scribe of his own errors, have been indicated in the footnotes as completely as possible. The first scribe has been designated A, the corrector B, wherever the two could be distinguished. When a variant is given as the reading of A, the reading adopted in the text is that of B, unless otherwise stated.

CONTRACTIONS. The contractions prevalent in French Mss. of the thirteenth century were freely used by copyist A; the expansion of them for the most part requires no explanation. As might be expected of so hasty and unmethodical a scribe, he sometimes used the same sign for two different purposes, or two different signs for the same purpose. In expanding the contractions it has been necessary to take into account the spelling of the same or similar words when written in full. Thus the sign 9 normally

represents *con* (e. g. *conpot* 2, *aconte* 13, *conme* 14, *connoist* 23) or *com* (9^e = *come* 116), but *cun* in *aucun* 302, 307 (cf. *aucun* in full, v. 274, etc.) The bar over a nasalized vowel before a labial consonant has been interpreted as *n*, not *m* (e.g. *nonbre* 17, *unbre* 18, *resenblent* 102), in view of the spellings *enbrache* 119 and *nonbres* 149 (*nombre* 224 is due to B). The bar was inadvertently omitted by the scribe in *enpru[n]te* 244 and *enpru[n]ter* 251, and added incorrectly in *sāns* 60. A similar bar is used to represent *u* after another vowel; thus *môt* 24, 240, *sôs* 52, *môteploier* 329, etc., and *sōme* 482 have been interpreted as *mout*, *sous*, *mouteploier* and *soume* respectively, in view of the spellings *sous* 182, *soume* 342, *mouteploieras* 358, *multeploier* 366, etc., and the parallel contractions *vâdra* for *vaudra* 245 (but cf. *vēdra* for *vaudra* 317) and *vôdras* for *voudras* 331. *Errāment* 277 may represent either *erranment* or *erraument*. The barred *p* represents *par* (e.g. *par* 16, *part* 37) and *per* (e.g. *pert* 27, *nonper* 313); it is wrongly used for *por* in *porra* 472, and conversely *p'* is used for *pro* in *prochene* 243 (corrected by B), 477, and *prochain* 487. The peculiar marks under *argorisme* in v. 4 are perhaps merely a method of underlining the word on its first occurrence. It should be added that, in the writing of copyist A, *n* and *u* are often indistinguishable.

VERSIFICATION. The metre employed is the ordinary Old French octosyllabic couplet. In a few instances the couplet principle has not been strictly observed. Three lines rime together in *-i* (vv. 101-3), five in *-és* (104-8), and five in *-ras* (249-53); but we are not justified in assuming that a line has been interpolated or omitted in each of these instances. Certain couplets which are palpably defective have already been mentioned. V. 85 has no line with which to rime, yet there is no sign of any gap in the sense. A small proportion of the lines, as presented by the Ms., do not possess the correct number of syllables. The corrections introduced by B have sometimes eliminated the metrical irregularities of A (e.g. in vv. 217, 264, 500 and 519), while in certain other lines corrections which restore the correct number of syllables are demanded by the sense (vv. 52, 77, 113, 138^e, 162, 231, 370). The remaining irregular lines could nearly all be restored to eight syllables by easy emendations, but such corrections have been relegated to the footnotes. Although it is highly probable that the careless scribe is responsible for the irregularities, the authors

themselves (whose skill as versifiers was not of a high order) were perhaps not incapable of sacrificing regularity of versification to the requirements of the subject-matter. The lines for which emendations have been suggested for metrical reasons are : (addition of a syllable) 7, 18, 60, 127, 164, 250, 298, 343, 355, 378, 442, 447, 455, 501; (omission of a syllable) 21, 76, 80, 158, 232, 241, 279, 296. It is less obvious what corrections should be introduced in vv. 87 (—1), 128 (—1), 134 (+1), 144 (—1), and 481 (—1).

Assuming that the work was composed in regular octosyllabic lines, we may note the following features in the counting of syllables. *Que* (pronoun and conjunction) normally undergoes elision before a vowel, but creates hiatus in vv. 3, 150, 196, 287, 293, 383, and 414. The vowel of *qui* is elided in vv. 55, 495 and 496 (?), and that of accusative *che* (from *ecce-hoc*) in vv. 354 and 433. *Se* 'if' undergoes elision except in vv. 7 and 292. *Si* (from Lat. *sic*) undergoes elision in v. 397. There is hiatus after *ne* 'or' in v. 426, and after a polysyllabic word in *figurē adente* 492. Internal vowels in hiatus are still intact (*seü* 51, *feïs* 227, *meïsme* 288, *roont* 402, *veïr* 414), except in *nient* 135-6. *Voir* 123 and *voier* 166 for *veoir* are probably corrupt (see the footnotes), while *veu* 495 probably has no connection with *veoir* (see the glossary).

The rimes are accurate, though occasionally obscured by the scribe's misspellings (vv. 2, 38, 52, 131, 159, 188, 303, 357, 441). The corrections introduced by B have improved the rimes in vv. 8, 68, 146, 223, and elsewhere. *Entre* : *trente* 157-8, ignoring *r* after a consonant (cf. *metre* : *amete* 332-3 A), is a normal Old French rime. *Meïsme* : *chifre* 288-9, a mere assonance, is perhaps corrupt. On rimes involving dialectal pronunciations see the following paragraph. The rimes are frequently leonine or rich. The authors did not shrink from riming a word with itself, sometimes with little or no difference of meaning (vv. 11, 65, 115, 135, 139, 181).

LANGUAGE. The text is written in continental French of the thirteenth century. A comparison of the forms of the manuscript with those assured by metre or rime leads to the conclusion that the scribe belonged to a considerably later period than the authors, and perhaps to a different region. The Ms. presents dialectal features which, though in no instance confined to a single province,

point to Picardy as the home of the scribe : *ch* for *c* before *e*, *i*, and yod (e.g. *ches* 42, *enbrache* 119, *tierche* 188, *esfaches* 378, *agenche* 408, *rachine* 506), confusion of intervocalic *s* and *ss* (*soufissent* 135, *truis* 254, 292), *s* written consistently for final *x* (e.g. *ars* 41, *piés* 105, *metés* 107), metathesis in *flabe* 159 and *mousterra* 482, the futures *saras* 175 and *aras* 509 without *v*, and *ceu* or *cheu* 3, 303, etc., as tonic form of *ço*, *ce*. Other dialectal traits, such as *muidres* for *mieudres* (= *meilleurs*) 144, the infinitives *voier* 166 and *veïr* 414, the substitution of *en* for *an* in *avent* 217, *vuil* for *vueil* 296, the feminine pronoun *lié* for *li* 342, the dropping of *i* between vowels in *mouteploëras* 358, 401, and *fies* for *fies* 443, are too isolated to serve as reliable evidence for localizing the scribe. None of the forms just mentioned can be attributed with certainty to the authors, while several (*flabe*, *voier*, *avent*, *truis*) are undoubtedly due to the scribe alone. In the rimes it is difficult to find anything which is not Central French. *L'en : rien* 145-6 may be a Picard rime in *ê*, or a Parisian rime in *ã*. The 1 pl. ending *-on* for *-ons* 46, 177, and the analogical subjunctive *mespraigne* 72, certified by rime in each instance, were widespread in northern France; while the analogical form *descriënt* 34 may have arisen in any area. The reduction of *ie* to *i* in *cri(s)me* (: *argorisme*) 8 — a development which occurs in Walloon, Norman, and other dialects besides Picard — and the somewhat doubtful *veu* (: *lieu*) 495 for *vuit* seem to be the only definite provincialisms.

The divergence between the practice of the scribe and that of the authors appears to be due in several instances to phonetic and morphological developments which took place in the course of the thirteenth century. Thus the authors recognized the presence of *s* before a dental consonant, distinguishing *conpot* < *computum* (: *pout* 5) from *conpost* < *compositum* (: *apost* 171, etc.); whereas the scribe sometimes omitted *s* before *t* (*conpot* 151, 172, etc., *tanstot* 152, 419, *soutraire* 437). When followed by *m*, *s* may have been mute even in the language of the authors, cf. *argorisme* : *crisme* (for *crieme*) 7. Initial *c* (= *ts*) was confused with *s* by the scribe, e.g. *ciënce* 23, *sifre* 210. The authors preserved internal vowels in hiatus, but the scribe reduced *veoir* to *voi(e)r* 123, 166, perhaps also *daërraine* (or *derreaine* ?) to *derrainne* 298, 355. It is not certain that the authors rimed *oi* with *ai*, the rime *lqit : estoit* 219 being disputable; the scribe, however, substituted *ai*

for *oi* (*tai* 478, *mains* 392, 472) and *oi* for *ai* (*soit* 13, 273, *soustroi* 19, *foi* 210). The only infractions of the Old French declension rules which can be attributed with certainty to the authors, apart from proper names, technical terms, and nouns or adjectives used predicatively, are *li gregnor* nom. sg. 183 and *mendre* acc. 232; the scribe, on the other hand, frequently substituted the accusative form for the nominative (vv. 8, 11, 67, 71, 93, etc.). The scribe added analogical feminine *e* to *oële* 241 and *alantes* 441, and probably expanded *Quil* into *Qui le* 80. The absence of nominative *s* from *mestre* 79 is guaranteed by the metre as a feature of the original text.

I am indebted to Dr. C. J. ONIONS and Mr. A. EWERT for their kindness in reading the manuscript of the present publication and suggesting some improvements.

[I]

- Li dui clerc qui ont translaté
 Conpot en roumans sunt hastés
 De plusors que a cheu [s']ametent
 Que en roumans argorisme metent,
 5 Ausi con il ont fait conpot,
 Que nul n'atint ne savoir pout
 Se il ne seit argorisme.
 Si en ha clerc honte et crisme,
 S'il ne seit conpot; ne doit estre
 10 Ne clerc ne diacre ne prestre.
 Chascun doit, qui a a savoir,
 Argorisme et conpot savoir;
 Que fous est si ne soit d'aconte,
 Si conme Ysidre nos raconte,
 15 Qui dit : ' Que ne soion destruit,
 Devon est[r]e par nonbre estruit.
 Oste de toutes choses nonbre,
 Toutes periront con unbre.
 Soustroï moi du siecle tout conte,
 20 Si le verras aler a honte '.
 Encore dit Ysidre meïsme :
 ' Qui de conpot et d'argorisme
 Ne connoist l'art et la ciënce,
 Que mout a poi de difference
 25 Entre li et la beste mue
 Que l'en met traire a la charue '.
 Et bien pert que Ysidre dit voir;
 N'est honte fors de nonsavoir.
 Il n'a tresor si boen eu monde
 30 Conme sens, quant de visde est monde;
 Quer li sens aide au besoig
 Et tost et tart et pres et loig.

[II]

- Set ars principal sunt, che diënt
 Li philosophe, et les descriënt
 35 Et devisent en .ii. parties,
 Qui en tel sens sunt departies
 Que l'une part appellent trive,
 Et l'autre part claïment quadruvie.
 Li trive gramere et logique

Fo. 13 a

fo. 13 b

[illegible]

l'ain Achates ^{meurt} et d'ame ^{meurt}
 d'ient n'enant a'ant fort un
 j'at fait l'aplace ombre
 ? ne porait on nul c'it
 Juste la l'ant d'arrade d'it
 Acpuet en la f'ind'et
 O'is a'ant d'ant f'ind'et
 ? est d'aucun l'ap'at
 ? d'ant d'ant d'ant d'ant
 my. 22

I. The two clerks who translated the computus into French are urged by many people to undertake the task of putting algorism into French, just as they did the computus, which no one ever grasped or could get to know without knowing algorism. A clerk suffers shame and fear, if he knows not the computus; he has no right to be a clerk or a deacon or a priest. Every man whose duty it is to have knowledge must know algorism and the computus; for he is a fool if he knows naught of reckoning, as Isidore tells us, who says : « In order to escape destruction, we must be instructed by means of numbers. Take away number from all things, and all will perish like shadow. Withdraw me all calculation from this world, and you will see it fall into shame. » Isidore himself says further : « If a man knows not the art and science of the computus and algorism, there is very little difference between him and the dumb animal that is put to draw the plough. » And it is very clear that Isidore speaks truth; there is no disgrace except from ignorance. There is no treasure in the world so good as intelligence, when it is free from cunning; for intelligence helps one at need, early and late, far and near.

II. There are seven principal arts, the philosophers say, and they describe and divide them in two parts, which are distinguished by their calling the one part trivium and the other part quadrivium. The trivium includes grammar, logic and rhetoric;

2. Final s of *hastés* added above line. 3. Ms. *ametētent*. 6. Ms. *p. savoir*; A *puet*. 7. *seit* added by B, *corr.* *savoit* ? 8. A *crieme*. 9. *soit* corrected to *seit*. 10. c of *diacre* added above line. 15-26. *Per numerum siquidem ne confundamur instruimur. Tolle numerum in rebus omnibus, et omnia pereunt. Adime saeculo computum, et cuncta ignorantia caeca complectitur, nec differri potest a ceteris animalibus, qui calculi nesciunt (var. nescit) rationem (Isidore of Seville, Etymologiae, lib. III, iv, 4, ed. W. M. Lindsay, Oxford, 1911, vol. I. 16. Senon corrected to Deuon; escrit corrected to estruit. 17. Oste] A Questre corrected to Estre. 18. Ms. pariront; con] corr. comme ? 19. A ciecle. 20. a] Ms. as. 21. corr. Encor ? 22. te of honte added above line. 30. A uisc corrected to uice ; the upper half of the letters de has been obliterated by a hole made in the parchment. 35. Ms. partiens. 36. Ms. departiens. 37. Que nule corrected to Que lune; A triuie. 38. Eu corrected to Et. 39. trueue corrected to triue. 40.*

- 40 Contient sus soi, et rethorique;
 Che sunt les .iii. ars que contiënt.
 Li quadruvie ches .iiii. tient :
 Arismetique, astronomie,
 Et musique et geometrie.
- 45 Chest quadruvie a .i. autre non,
 Quer art matematique avon.
 Matematique n'a riens el
 Fors esciënce dotrinel.
 Li sens de quadruve a tant monte
- 50 Qu'il ne puet estre sans aconté
 Seü par nule riens qui vive;
 Por che fu trové sous quadruvie
 Argorisme, par qui doctrine
 Nos avon des .iiii. ars l'orine
- 55 Qui en quadruve sunt contenues,
 Qui ne püent estre seües
 Sans aconté, plus que poon
 Lire se les .iii. ne savon,
 Ou que poon latin entendre
- 60 Sans nostre Donnet aprandre,
 Ne plus que chanter ne savon
 Se game ou sofe apris n'avon.
 Por cheu que conpot est partie
 Et espece d'astronomie,
- 65 Et que conpot a maint aconté
 Fort et grief, qui ne set d'aconte,
 Si conme est li saut de la lune
 Et plusors fois que l'on aüne
 Les ans de grace en itel guise
- 70 Que l'on les depart et devise fo. 13 c
 En tel sens con conpot enseigne,
 Pour soul tant que l'en n'i mespraigne
 A ches acontes aconté,
 Por sol tant volons translater
- 75 Argorisme en romans briement,
 Que l'en aprendra naturellement.
 Argorisme fu fait [en] Grece;
 D'arismetique est une espece,

these are the three arts that it contains. The quadrivium comprises these four : arithmetic, astronomy, music and geometry. This quadrivium has another name, viz. the art of mathematics. Mathematics contains nothing else but theoretical knowledge. The quadrivium is of so difficult a nature that it cannot be known without reckoning by any living being; for this reason algorism was devised under quadrivium. By its teaching we have the basis of the four arts contained in quadrivium, which cannot be known without reckoning, any more than we can read if we do not know the three, or can understand Latin without learning our Donatus, or can sing without having learnt scales or notes. Because the computus is a part and subdivision of astronomy, and includes many a calculation which is difficult and irksome, if one knows not how to reckon — for instance the *Saltus lunae* and many occasions when the years of grace are assembled in such a manner that they are separated and divided in accordance with the teaching of the computus — for the sole purpose that no mistake may be committed in making these calculations, we wish to translate algorism concisely into French, which will be learnt without difficulty.

III. Algorism was made in Greece; it is a subdivision of

Contrueue corrected to Contient. 41. *Ms. continent.* 48. *Ms. esicience, first i expuncted.* 50. *Ms. piet.* 52. *Ms. trouee; d cancelled after sous; i of quadruvie added above line.* 56. *i of Qui above an erasure; eus cancelled after Qui.* 58. *s of savon expuncted.* 59. *n of poon corrected from m.* 60. *Ms. Sāns; Ms. donneet, corr. Donatus?* 62. *Se game written at the end of 61, insertion marks by B indicate its proper place; aprise corrected to -is; nen auon cancelled before nauon.* 63. *A Par; A conpote.* 64. *Ms. espere.* 66. *est cancelled after grief.* 67. *A v saut corrected to lui s.* 68. *s of fois corrected from t; A qui lont eue corrected to qui lon, a uue.* 70. *lon added by B.* 71. *i of enseigne added above line.* 72. *sous corrected to soul; i mespraigne corrected to ni mesp.* 74. *sou altered to sol; s of volons added above line.* 76. *Quen corrected to Que; corr. Qu'en?*

- Et li mestre Argorisme out non
 80 Qui le trova et li mist son non.
 Por che qu'il out non Argorisme,
 Mist non a son livre ' argorisme ' ;
 Argorisme eut non ensement.
 Nos moustre et ensaigne comment
 85 En argorisme devon prandre
 .vii. especes, qui boenes sunt
 Et beles, qui tel[s] nons ont :
 Addition, subtration,
 Doubloison, mediation,
 90 Mouteploie et division,
 Et de radix eustration.
 A ches .vii. especes savoir
 ' Doit chascun en memoire avoir
 Letres, qui figures sunt dites,
 95 .ix., qui en tel sens sunt escrites :
 9. 8. 7. 6. 5. 4. 3. 2. 1.
 Ches lettres sunt de tel sentence
 Qu'il vuelent que l'en les conmenche
 A escrire ve[r]s la par[t] destre,
 100 En escrivant vers la senestre.
 Un es[t] itel conme .i. ' i ' ,
 Et .ii. resenblent totedi
 Une faucille; trois, enmi
 Tornés, ch'il qui est betornés.
 105 Quatre est un ' o ' qui a .ii. piés.
 .v. par ' h ' envers escrivés.
 Por .vi. .i. ' G ' tornés metés, fo. 13 d.
 Et por .vii. .i. ' v ' adentés.
 Metés .i. 8 en une croche,
 110
 Quant or ses chascune figure
 Conoistre selon sa nature,
 Et [que] chascune senefie,
 Lors sachiés, si ne doutés mie,
 ' 115 Que chascune est premier en nombre
 Tant come vaut sans autre nombre.
 En secont lieu vaut .x. fois tant

arithmetic, and the master was named Algorism who invented it and gave it his name. Because his name was Algorism, he called his book 'algorism'; it too was named algorism. He shows and teaches us how in algorism we must take seven operations, which are good and fair, bearing the following names: addition, subtraction, duplation, mediation, multiplication, division, and extraction of root. In order to learn these seven operations everyone must remember nine letters, which are called figures, written as follows: 9, 8, 7, 6, 5, 4, 3, 2, 1. These letters are of such a nature that they require to be begun on the right and written towards the left. One is like an 'i', and two always looks like a sickle; three, which is indented in the middle, is like a pair of eyebrows placed sideways. Four is an 'o' with two feet. Write five by 'h' upside down. For six put a 'G' turned round (*or*, a horned 'G'?), and for seven place a 'v' face downwards. Put an eight (*or*, an egg?) in a hook, When you are able to recognize each figure according to its nature, and what each signifies, then know, and have no doubt, that each one when first in a number has just its own value without any other number. In the second place it is worth ten times as much as in the previous

79. *A* cut. 80. *corr.* Quil? 81. *A* cut. Line missing after 84? 88. *A* Adision. 89. Soubloison corrected to Dou-; *A* meditaton. 91. *A* eustation; *corr.* extraction (us x)? 96. The figures 5. 4. 3. 2. 1. o, written by *A*, were struck out by *B*, who inserted 5. 4. 3. 2. 1. above the line, after writing and striking out 9. 8. 7. 6 (?) at the end of the line. 101. *Ms.* Vne, e added above line; en, corrected to es. 102. En corrected to Et; *A* toute dui. 103. enmi] *A* ni e. 105. .o. added above line; .iiii. corrected to .ii. 107. *corr.* cornés? 108. .vii.i.] *Ms.* .viii., corrected to .vii.; *A* adestres. 109. 8] *A* of, corrected by *B* to 8 ou wit. 112. selon *Ms.* se non. 117. *A* seconté; *A* fauissant. •

- Conme el fesoit eu lieu devant.
 En tiers lieu .x. tans en enbrache
 120 Qu'il ne fait en seconde place,
 Et en quart lieu .x. tans contient
 Que en tiers lieu qui devant vient.
 Che poués voir en tel maniere,
 Et qui te senble plus legiere :
 125 Figure, quant vos la metrés
 En premier lieu, vaut unités,
 Et en secont vaut disime,
 Et en tiers lieu vaut centisme;
 En quart lieu milliers senefie;
 130 S'outre mil va, n'oublier mic
 Que toujours n'ailles .x. doublans
 , Quanque tu escrias avant.
 Ches figures que je t'ai dites,
 Qui devant en ordre sunt escrites,
 135 A conter ne soufissent nient
 Sans cheste : ' o ', qu'e[n] claime nient,
 Qui riens ne vaut, ne fait fors unbre,
 Itant fait [a] la plache enconbre,
 Et neporquant en nul escrit
 140 N'iert ja sans li article escrit;
 Ne puet en soi fructefier,
 Mais autres fait senefier;
 Et est d'aucuns chiffre apelee
 Et des maiorz clers nonmee,
 145 Mais par cifre l'apele l'en fo. 14 a
 Mout plus que par nulle autre rien.
 [iv] Or devon progression dire,
 Qui t'aprandra nonbre a escrire.
 Trois manieres de nonbres sunt
 150 Que argorisme savoir font :
 C'est doi, et article, et conpot.
 Du doi vos voeill dire tanstot.
 Doi est nonbre qui dedens .x.
 Est contenu, si con'm'est sis
 155 Ou quatre ou .ix. ou .vii. ou .viii.
 , Article est nonbre issi dit

place. In the third place it embraces ten times as much as in the second place, and in the fourth place it contains ten times as much as in the preceding third place. You can see this in the following manner, which may seem easier to you : if you put a figure in the first place, it is worth units, in the second it is worth tens, in the third place hundreds, and in the fourth place it denotes thousands ; if it goes beyond a thousand, on no account forget always to multiply by ten whatever you write in successive places. These figures which I have mentioned to you, written in their order above, are not sufficient for reckoning without this one : o, called naught, which is worth nothing, creates nothing but shadow, to such an extent does it encumber the ground, yet no article will ever be written in any work without it ; of itself it can bear no fruit, but it gives significance to others ; by some, including the clerks of greatest learning, it is called *chifre*, but it is designated by the term *cifre* much more than by anything else.

IV. Now we must explain progression, which will teach you how to write numbers. There are three kinds of numbers which algorithms bring to our knowledge, viz. digit, article and composite. I will tell you forthwith about the digit. Digit is a number contained within ten, such as six, four, nine, seven, or eight. Article is

118. eu corrected to el. 123. e of poués added above line; corr. Che pués veoir ? 126. vaut] A la. 127. corr. secont lieu ?; corr. disaines (cf. 157) ? 128. corr. centains ? 130. S'outre] A Sen treus; Ms. vas, s added above line; A noublies. 131. n'aïlles] A uaies. 135. souffissent] A so ache. 136. Sans] A A; the o is obliquely barred; A vient. 143. A sifre. 144. maiorz] A muidres. 145. par cifre] A fer fisie. 146. plus que] A quer; A par nul autre nop. 147. devon] A teuml, ml corrected by B to on; porgression corrected to prog-; drre corrected to dire. 152. voeill] A uill; Ms. tanstost, second s expuncted. 153. dis expuncted before .x. 154. conme'est] A conme; sis] A vis. 156. nonbre

- Qui tousjorns en disainnes entre;
 Articles est .x. ou .xx. ou .xxx.
 Et .xl. et nonbre sans flabe
 160 Qui en disimes est finable.
 Conpot est nonbre ensenble atret,
 Qui de doi et d'article est fait,
 Si conme .xi. et .xii. et .xiii.,
 Et conme est chest nonbre : .xvi.,
 165 Qui de .vi. et de .x. est dit;
 Ce pouons voier sans contredit,
 Car .x. est article par soi,
 Et .vi. qui mains est a non doi.
 S'auscuns veut aucun nonbre escrire,
 170 Primes doit prandre, bien l'os dire, ...
 Et ne li doit pas estre apost
 S'il est d'article ou de conpot.

- De quel article ou de quel doi
 175 Il est conpot; quant che saras,
 Ton doi tout devant escriras.
 Ton article, che te dison,
 Metras après sans mesprison.
 En tel sens con as oï dire
 180 Doit chascun ches nombres escrire.

[v] Addicion.

- Qui veut nonbre a nonbre ajoster,
 Si doit l'un sous l'autre ajoster, fo. 14 b
 Et doit estre escrit li gregnor
 Desus et desor le menor,
 185 Si que la figure premiere
 Soit sous l'autre primeraniere.
 Et seconde soit sous seconde,
 Et tierche sous tierche responde.
 Après conmenche en la part destre
 190 A ajouster vers la senestre.

- Desous, si con il est droiture,
 Ou l'autre desus la premiere.
 Et puis esgardés la maniere
 195 Du nonbre qui des deus vendra,

the term applied to a number which splits up entirely into tens. Ten, twenty or thirty is an article, forty also, in short any number which is divisible into tens. Composite is a number drawn together, composed of digit and article, such as eleven, twelve and thirteen, and like this number : sixteen, which is represented by six and ten; we can see this to be undeniably the case, for ten is an article in itself, and six which is less is called a digit. If anyone wishes to write a number, he must first, I venture to assert,; and he must not mind if it consists of an article or of a composite of what article or of what digit it is a composite; when you know this, you must write down your digit in the first place of all. Your article, we tell you, you must put after it without fail. In the manner that you have heard explained everyone must write these numbers. •

V. *Addition.* He who wishes to add one number to another must place the one close beneath the other, and the greater must be written above and over the smaller, in such a way that the first figure of the one is beneath the first figure of the other, and the second beneath the second, and the third corresponds beneath the third. Then begin adding on the right, working towards the left beneath, as the right method is, with the other above the first. And then ascertain the nature of the number which results from the two, and be assured that

repeated at end of line. 157. *Ms.* Que; *v* of tousjourns corrected from *u*; disainnes] *A* .x. aunis, *i* expuncted; escrit expuncted before entre, entre repeated above line by *B*. 158. *corr.* Article ?; *o* of first *ou* added above line, *ou* repeated above line by *B*. 160. *corr.* disaines ? 162. *est* added above line; fait] *Ms.* atrait. 163. *vi*, corrected to *xi*, perhaps by *B*; *Ms.* xvii, *v* expuncted; *vi* erased above *xiii*. 164. *corr.* Et si comme ?; *s* expuncted before *xvi*, *B* repeated *xvi*. 166. *Ce*] *Ms.* *Se*; pouons] *A* pous; *corr.* *Ce* pués veoir (*cf.* 123) ? 167. par soi] *A* parst. 168. *a*] *A* en; doi] *A* de. 174. chest doi corrected to quel. 177. dison] *A* ron. 170. *a* of as • corrected from *t*. 180. Soit corrected to Doit; ches] *Ms.* chet. 186. *Ms.* primemaniere. 187. soit repeated. 188. *i* of second tierche added above line; *Ms.* respont. 189. Et expuncted before Après. 195. des deus] *Ms.* dedens.

- Et sachiés que il avendra
 Qu'il soit doi, article, ou conpost.
 S'il est doi, droit est que l'en l'ost
 La figure desus, et fache
 200 Autre figure en cele place
 Qui vaille tant con il valioient,
 Les .ii. qui devant i estoient.
 Et si te convient acoster
 D'article faire a l'ajouster,
 205 Eu lieu desus cifre feras,
 Et t'unité trespousseras,
 Qui valoit .x., et si l'ajoute
 Ou l'autre figure dejoute;
 Et se de .ix. est la figure,
 210 .i. sifre me foi a droiture,
 Et t'unité avant joindras
 O cele qu'enchiés trouveras.
 S'encor t'avient a l'ajouster
 Qu'a conpost t'esteuche acoster,
 215 Lor escri eu lieu desus doi,
 Et porte l'article par soi
 Au lieu avent, ou en la guise
 Que nos avon devant aprise.
 Quant nule article onques ne lait fo. 14 c.
 220 Remaindre eu lieu ou ele estoit,
 Issi avras adiciun.

- [vi] Sustracions. Après aprent subtracion.
 Et se ve[u]s nombre d'autre estrere,
 Tu dois ton greignour nombre faire
 225 Desus et desor le menor,
 Tout autresi en tel tenor
 Con feïs en adicion;
 Quar nullui par subtracion
 Ne puet, por riens qu'il puisse fere,
 230 Grant nombre de petit subtraire,
 Mes le grant se puet bien est[reind]re
 Et souffrir que l'en le fache mendre.
 Et se veus soustraire, sor destre
 Conmenche, et soustrai a senestre,

it will prove to be a digit, an article, or a composite. If it is a digit, one should remove the figure above it, and make in its place another figure worth as much as the two were worth which were there before. And if on adding it befalls you that you have to make an article, you must make a cipher in the place above, move your unit (which was worth ten) farther on, and add it to the figure next beside it; and if the figure is nine, make me a cipher in the proper manner, and you must join your unit with that which you find next after it. If further it befalls you on adding that you have to encounter a composite, then write a digit in the place above, and carry over the article alone to the next place, or in the manner that we have already taught [vv. 209-12]. When no article at all is left in the place where it was, your addition will be complete.

VI. *Subtraction.* Next learn subtraction. If you wish to take away one number from another, you must write your greater number over and above the smaller, in just the same way as you did in addition; for no one can by subtraction, whatever he may do, subtract a great from a small number, but the great can very well compress itself and allow itself to be made smaller. And if you wish to subtract, begin on the right, and subtract towards

197. s of conpost *added above line.* 198. omit second l' ? 201. A vallent; Ms. valoit, e *added above i.* 203. si] A cil; te] Ms. tel, l *expuncted*; A aconter. 205. A sifre; ferons *corrected to* feras. 206. A Et tu ne te; trespasseſas *corrected to* -pousseras. 214. A tēste aconter. 215. A Loresoī. 217. en *added by B.* 219. pres *expuncted before* nule; onques] A apres. 223. A estret. 224. *added by B in left margin.* 228. A nule. 230. Grant] A Si aut. 232. que l'en] *corr.* qu'en ?; *corr.* meindre ? 234. Ms. Cēnment che; A soustie. 235. Ms.

- 235 Et oste la basse figure
 De cele desus a droiture.
 Aucunefois ne la savras
 Oster, quant egaux les verras,
 Ou troveras cele desus
 240 Mout menor que ceste dejus.
 S'elle est oële, tu l'osteras
 Et ton cifre iluec poseras.
 S'il est menor, de la prochainne
 Figure enpru[n]te .i. disaine :
 245 Che sera un, qui .x. vaudra.
 Ches .x. ajoster covendra
 A la figure dedevant,
 Mais che n'est mic en escrivant,
 Mais en ton cuer la poseras.
 250 Cele desor sereras,
 Quant ton .x. enpru[n]ter devras;
 [C]elle desous en soustreras.
 Tele ore iert, cifre i troveras;
 Et s'il avient que tu li truis
 255 N'avoir en li qu'enprugter puisses,
 Outre le chiffre passeras,
 A cele qu'enchiés troveras
 Enprunteras une unité.
 Et saches bien de verité fo. 14 d.
 260 Que nule unité enpruntee
 Ne porroit pas estre aportee
 Par desous .i. chiffre au soustrere
 Sans faire de li novenere.
 Quant a son liu [l']avras atrete,
 265 Lors iert cele desous soustrete
 Du nombre que desus avras,
 Et le remanant i leras.
 Ajouster savras et soustrere,
 S'isi con je te di ses faire.
 270 Et saches que subtracion
 Preuve l'on par adicion,
 Et adicion par soustraire
 Preu[v]e cil qui bien le soit faire.

the left, and take away the under from the upper figure in the proper manner. Sometimes you will not be able to take it away, when you see them equal; or you will find the upper figure much smaller than the lower. If it is equal, you must remove it and put your cipher there. If it is smaller, borrow a ten from the next figure, i.e. one, which will be worth ten. These ten must be added to the preceding figure — not, however, in writing, but you must set it down in your mind. When you have to borrow your ten, you must reduce (?) the upper figure; you will [afterwards] subtract the lower from it. Sometimes you will find a cipher there; if it does happen that you find it to contain nothing that you can borrow, you must pass beyond the cipher, and from the figure that you find next to it borrow a unit. And know for certain that no borrowed unit could ever be brought under a cipher, when one is subtracting, without making it into a nine. When you have brought it into its place, then the figure below must be subtracted from the number that you have above, and you must leave the remainder there. You will know how to add and subtract, if you can do as I tell you. And know that subtraction is proved by addition; and he who knows well how to do it proves addition by subtracting.

ostee, second e expuncted; la] A de. 236. Se corrected to De. 237. la] A le. 238. A egaus; s of les added above line. 239. Ms. Outre uerras. 241. A Cele est; corr. oël ? 242. A sifre; A poteras. 243. A cil; A p'chene. 245. un] Ms. vii; A vādra, B vaudra. 246. i of aioster corrected from n. 247. A] A Ou. 249. added by B. 250. corr. resereras ? 252. added by B in left margin, first letter rubbed away; omit this line ? 253. Cele corrected to 'Tele'; A sifre. 254. s'il] A cil. 255. N'avoir] Ms. Naura. 256. Outre] Ms. Entre. 262. A nouere. 264. liu] A li; atrete] A streste. 265. A Lor; soustrete] A son estre. 267. A A le remanant illerras. 268. A Ne oster sauras ne son estre. 270. A siches. 271. Preuve] A Prangne. 273. A Por quoi uequit

[vii] Duplaciuns. Qui veut aucun nonbre doubler

- 275 Les figures doit assenbler
 En une ligne soulement,
 Et doit conmenchier erranment
 A doubler l'ultisme figure.
 Et se cel double est de tel nature
- 280 Que son nonbre dedens .x. soit,
 La soit mise ou l'autre estoit.
 Et se .x. avient au doubler,
 Ne te dois de cheu controubler,
 Mes pur le .x. cifre feras,
- 285 Et [t'] unité avant metras.
 Et se ton nonbre outre .x. va,
 , Pran cheu que outre .x. sera
 Et le pose en cel lieu meïsme.
 Les .x. qui remaignent sans chiffre
- 290 Par figure dun poseras
 Arriere, et si l'ajosteras
 Ou autre, se illuec la truisés,
 Por che que ajoster la puisses;
 Et si iras en descendant
- 295 Chascune figure doublant.
 Et encore te vuil anonchier
 Qu'a doubler doit l'en conmenchier
 A la figure desrainne
 En alant vers la premeraine,
- 300 Quar qui la premiere voudroit
 Doubler primes, li convendrait
 Aucun nonbre doubler .ii. fois;
 Por ceu que conmenches, ch'est droit
 A doubler cele de derriere,
- 305 Et double au derrain la premiere.

fo. 15 a.

[viii] Mediaciuns. Se tu te veus avoisdier

- A aucun nonbre medier,
 A la premerainne figure
 , Dois conmenchier, que c'est droiture;
- 310 L'une moitié en osteras,
 Et l'autre moitié i metras.
 , En tous les sens fors [e]u premier

VII. *Duplation*. He who wishes to double a number must collect the figures in a single line, and must forthwith begin doubling the last figure. If that double is of such a nature that its number is less than ten, let it be placed where the other figure was. And if the doubling produces ten, you must not be disconcerted at this, but for the ten make a cipher, and put your unit in front. And if your number exceeds ten, take the excess over ten and set it down in that same place. You must then by means of a figure put backwards [i.e. on the left] the remaining ten, without the cipher, and set it against another figure, if you find one there, in order that you may add it; and you must go down the line, doubling each figure. I would also point out to you that in doubling one must begin at the last figure [i.e. on the left] and work towards the first, for if one wished to double the first first, one would have to double some number twice; in order to (?) begin, it is correct for you to double the last figure first, and you must double the first last.

VIII. *Mediation*. If you would acquire skill in halving a number, you must begin at the first figure [on the right], for this is the proper method; you must take away one half from it, and put the other half there. In all positions except the first

bien le sais faire. 275. O expuncted before les. 277. or erraument. 278. Ms. luitisme. 279. omit Et ?; de added by B. 281. Ms. lautre soit. 282. avient] A en vient. 284 x] A v, corrected by B to xx, and vint in right margin; A sifre. 285 or Et [l']unité ? 286. outre] Ms. entre. 287. x added by B. 288. cel] Ms. cil. 294. Et added before the line; corr. Issi ? 296. corr. encor ?; te added by B. 298. deraine altered to desrainne, corr. daerraine or desreaine (cf. 355) ? 299. A aler. 302. nonbre] A m̄bre; doubler] A dauoir. 303. que] corr. quant ?; s of conmenches added above line; est added above line by B after chest; corr. drois (cf. 337, 481) ? 304. de added by B. 305. A dernier. 306. te] Ms. ten; A aueoisdier, first e expuncted, voisdier added above line by B. 307. A] A En; A mendcier. 308. A premere. 309. Dois] A Du. 310, 311. A metie.

Dois nonper nonbre medeier
 En tel sens : .i. en dois oster,
 315 Et la metié illuec noter.
 Cele unité que osté avras,
 Quant .x. vaudra, mipartiras;
 A la moitié de .x. ch'es[t] .v.

320
 Et l'autre rejoig en la ligne
 Que primes trouveras vers destre.
 Lors seras de medier mestre.
 Et si t'estuet un departir,
 325 En son lieu dois cifre gerpir,
 Et .i., ch'est la moetié de li,

[ix Multiplicaciuns.] Se tu veus ton sens enploier

En aprandre a mouteploier,
 330 Escri tout ton nonbre premier
 Que tu voudras mouteploier;
 Et par desus l'un l'autre met
 Qui a mouteploier s'amet,
 En tel sens que la premeraine
 335 Figure soit sous la derroenne
 De cheu que mouteploier dois
 A mouteploier, quer ch'est drois,
 L'ultime figure desus
 Par l'ultisme du nonbre jus
 340 Et tantes fois la conteras,
 Et desus unités avras.
 La soume qui de lié vendra
 Asoer la te covendra
 Sus la figure derraene,
 345 Qui de mouteploier se painne.
 Se ta multiplicacion
 Te fait d'article mencion,
 Escri sor le mouteploiant
 .i. cifre, et met l'article avant.
 350 S'il avient a mouteploier
 Qu'a conpot t'estueche apoier,

fo. 15 b

[on the right] you must halve an odd number in the following manner : you must take away one from it, and write down the half there. You will divide that unit which you have taken away into two parts, when it becomes worth ten; half of ten is five and transfer the other to the line that you find next on the right. Then you will be expert in halving. And if you have to divide one, in its place you must leave a cipher, and one (?), i.e. half of it

IX. *Multiplication.* If you wish to employ your wits in learning to multiply, first write out your whole number that you wish to multiply; and one who undertakes to multiply places the one above the other in such a manner that the first figure [of the multiplier] is beneath the last of that which you have to multiply [Begin] to multiply the last of the upper figures by the last of the lower number, for that is the right method and you will count it so many times, and above you will have units. You must place the total which comes from it over the last figure, when you are striving to multiply. If your multiplication results in an article, write a cipher over the multiplier, and carry forward the article. If it comes to pass in multiplying that you have to encounter a composite, you must

312. sens] *corr.* lieux ? 313. oblique bar after nombre. 317. vaudra] *Ms.* vendra. 321. *A* leioig. 322. Que] *Ms.* Qui. 323. *Ms.* mesdier, s *expuncted*. 324. un] *Ms.* vii. 325. *A* sifre. 326. i] *corr.* $\frac{1}{2}$? 330. tout ton] *A* tou. 332. met] *Ms.* metre. 333. *Ms.* samete. 336. *A* Se cheu, *corrected by B* to Sur chen. 338. *A* Li vitisme. 339. *Ms.* luitisme. 341. unités] *A* uitismes. 343. *corr.* Aseoir ? 344. *corr.* Desus ? 345. *A* pene. 348. *Ms.* Escrit, t *expuncted*. 349. l'article] *Ms.* la tierche. 351. *A* testuct.

- Sous le moutepleant ton doi
 Metras, et l'article avant toi.
 Quant ch'avras fait, repren t'alainne,
 355 Mouteploie la derrainne
 Par la penultime autre fois
 Du moutepleant, quer ch'est droit.
 Encor la mouteploëras
 Par totes cheles que verras
 360 Qui seront eu moutepleant.
 Quant avras issi fait, a tant
 Les figures remüeras,
 Multepleanches i feras
 Que la prime multepleance
 365 , Soit sous la peleultisme estance.
 Puis dois multeploier arriere
 La figure endroit la premiere,
 Qui desus la premiere est mise,
 Et la mouteploie en tel guise
 370 Con tu feïs cele dejouste.
 Le nonbre, quant vendra, ajouste
 Ou l'autre nonbre, si verras
 Sour cheu dont mouteploic as. fo. 15 c.
 Et pran bien garde et i met cure,
 375 Quant avras aucune figure
 Mouteploic par la premiere,
 Qu'a mouteploier est maniere
 Que chele desus esfaches,
 Et en chel lieu le nonbre faches
 380 Qui t'avendra de l'action
 De la multiplicacion.
 [x] Aucune fois te ravendra
 Que aucun grant doi covendra
 Mouteploier par li meïsme.
 385 Issi l'ensengne l'argorisme,
 Et garde ne te soit ennui :
 De combien .x. est plus de li
 Cele difference osteras
 Du doi, et devant la metras,
 390 Et la mouteploie par soi.

put your digit beneath the multiplier, and carry forward the article. When you have done this, recover your breath, then multiply the last figure [of the multiplicand] over again by the penultimate figure of the multiplier, for that is the correct procedure. You must multiply it also by all those figures which you will see to be in the multiplier. When you have done so, you must then shift the figures, and make multiplications among them in such a way that the first multiplication is beneath the penultimate position. Then you must go back and multiply the figure against the first, that which is placed over the first, and multiply it in the same manner as you did the one beside it. Add the number, when it is obtained, to the other number, and on doing this you will see what your multiplication amounts to (?). And be mindful and careful about this, that when you have multiplied a figure by the first, it is the proper procedure when multiplying to efface the figure above, and to write in its place the number which you obtain by the act of multiplying.

X. Sometimes it will also befall you that a large digit must be multiplied by itself. The method taught by the algorism — beware of finding it irksome -- is as follows : take away from the digit the difference by which ten exceeds it, put it in front [i.e. to the right of the digit], and multiply it by itself. Thus

354. *A talaine.* 355. *A derroene, cf. 298.* 356. *A peultisme.* 357. *corr. dois (cf. 303) ?* 364. *Que] Ms. Qui.* 370. *Ms. fais.* 372. *si] A il.* 373. *A Sor.* 374. *Ms. gardae, second a expuncted.* 378. *corr. dedesus or de desus (cf. 304) ? ; Ms. esfachies, i expuncted.* 381. *Ms. multiplicacōn.* 383. *tauendra corrected to cou-*

- Essi mouteploie l'on doi,
 Que riens ne mains ne plus n'i a;
 Che saches *verbi gratia*.
 Se savoir veus et estre enduit
 395 Conbien font .viii. fices .viii.,
 Ce pués savoir par tel sentenche :
 Soustrai [l]es .viii.; s'a differenche
 Qui est entre les .viii. et .x.,
 Che sunt .ii.; lors remaignent .vi.
 400 Les .ii. devant les .vi. metras,
 Issi les mouteploëras.
 Les .vi. et les .iiii. en roont
 Soisante .iiii. te feront.
 Se .i. doi mouteploie autre doi,
 405 Esgarde bien chascun par soi,
 Et puis soustroï du doi greingnour
 La difference du menor;
 Et puis mouteploie et agenche
 L'une par l'autre difference. fo. 15 d
 410 Issi fere le covendra .
 La soume qui des deus vendra
 Soit devant la figure mise
 Dont la difference fu prise,
 Puis pués veïr que il i a.
 415 Che voies *verbi gratia*.
 Par .viii. fois .vii. se veus savoir
 Que la soume d'eus puet avoir,
 La difference du menor
 Soustrairas tanstot du greignor;
 420 Lor avras .v. por remanant.
 Et fai conme je di[s] devant,
 Et a mouteploier conmenche
 .ii. par .iiii.; par tel difference
 Avras .vi.
 425 et ch'iert l'onsisme.
 [xi Divisjuns.] S'aprandre veus ne aviser
 Nonbre par autre deviser,
 Le devisant nonbre esciras
 S[o]us cel que tu deviseras.

does one multiply a digit, and there is nothing more or less in the matter. An example will make this clear. If you wish to know and be instructed what eight times eight amounts to, you may ascertain it in the following manner : subtract the eight [from ten]; there is a difference between eight and ten, viz. two; then there remains six. You must put the two in front of the six, and multiply it [the two] [by itself]. The six and the four combined will give you sixty-four. If a digit multiplies another digit, examine each well separately, and then subtract from the greater number the difference of the smaller [from ten]; then multiply accurately the one difference by the other. That is how you must do it. Let the total resulting from the [multiplication of the] two be placed in front of the figure from which the difference was deducted, then you can see what the answer is. An example will illustrate this. If you wish to know what is the total resulting from eight times seven, you must forthwith subtract from the greater the difference of the smaller [from ten]; then you will have five left. Do as I said before, and begin to multiply two by three; when the difference [from ten] is of this amount, you will get six and it will be the eleventh (?).

XI. *Division*. If you wish to learn or comprehend how to divide one number by another, you must write the dividing number beneath that which you are going to divide. Bring the

391. lon] *A* du. 395. fices .viii.] *A* si a difference. 396-7. *added by B in left margin*. 398. x] *Ms.* vx. 399. *Ms.* remaignant. 403. *A* Sus autres iiii te feront. 404. autre] *Ms.* entre, *e* corrected to a. 406. *Ms.* Et puis lesoustroi, Et expuncted; *A* greingos. 408. *first e of agenche corrected from o*. 411. des deus] *Ms.* dedens (*cf.* 195). 417. d'eus] *A* done et. 420. por struck out before v. 421. or j'ai dit?

- 430 Ta figure derrainne maine
 Ou devisé sous la derrainne .
 Du nonbre que dois deviser.
 Et ch'estuet après aviser,
 Savoir, se l'en purra[s] soustraire.
- 435 S'il avient que ne puisse[s] faire,
 Sous la peleultime la met.
 Après a soutraire te met
 L'ultisme figure dejus
 Du nonbre qui sera desus
- 440 Tante fois que par autretans
 Repuisses les devant alantes
 Du nonbre desus oster;
 Et les fies dois noter
 Desus la figure premiere
- 445 Du devisant, en tel maniere fo. 16 a
 Que se tu .iiii. fois soutrais,
 Quatre fois desus portrais,
 Se .ix. fois soutrais, .ix., et pose
 D'autre soustraire te repose,
- 450 Quar autre .ix. ne pués soutraire.
 Et quant or savras issi faire,
 T'es figures remüeras,
 L'une après l'autre poseras,
 Et deviseras en la guise
- 455 Que tu as devant aprise.
 Sans deviser ne pués soustraire
 Nule fois. Issi t'estuet fere
 Le nonbre ou les fois sunt escrites.
- [XII Quadraciuns.] Or t'ai les .vi. espeses dites.
- 460 Or repués quarreson aprendre,
 Mais il i estuet mout entendre.
 Se revues d'aucun nonbre traire
 La raïz, issi le pués fere.
 Esgarde premier s'est nonper
- 465 Des figures le nonbre, ou per.
 S'il est per, s[o]us la pelcultisme
 Poseras ta figure prime.
 • S'il est nonper, lors te repose,

last of your figures in the divisor beneath the last of your dividend. Next you must consider this, namely whether you will be able to subtract it from the figure above. If it happens that you cannot do so, put it beneath the penultimate figure. Then begin to subtract the last figure below from the number above so many times that on each occasion you can take away the preceding numbers also from the number above ; and you must write down the number of times above the first figure of the divisor, in such a manner that if you subtract four times, indicate four times above, if nine times, nine, and for a while desist from any further subtracting, for you cannot subtract another nine. When you have learnt how to do thus, you must shift your figures, place them one after the other, and divide in the manner that you have already learnt. You cannot on any occasion subtract without dividing. In this way you must make up the number in which the times are written.

XII. *Square Root.* Now I have explained six of the operations to you. Now you may learn square root in its turn, but it requires close attention. If you wish next to extract the root from a number, you can do so as follows. Consider first if the number of the figures is odd or even. If it is even, you must place your first figure beneath the penultimate. If it is odd, then do not do so, but under the

431. *corr.* devisant or deviseur ? 438. *Ms.* Litiusme, s added above line; *Ms.* deuisse, second e expuncted. 441. t of devant altered to s; *corr.* alans ? 442. *corr.* dedesus ? 443. *corr.* fiees ? 445. Du] A De. 447. *corr.* dedesus ? 448. Se ix barred, se .9. written in margin by B. 455. *corr.* dedevant ? 458. Le] *Ms.* El. 459. vi] *Ms.* vii. 460. or carreson ?, *Ms.* larreson. 463. La raiz] *Ms.* Lairas. 464. s'est] A chest. 467. *Ms.* primes.

- Mais [sous] l'ultisme tele pose
 470 Qui menee par soi tantost .
 Tout le nonbre desus en ost,
 Ou [au] mains tant conme ele porra;
 Et quant cele desus sera
 Oste, maintenant la quasse.
 475 Double après la figure basse,
 Et vers la destre par[t] la maine,
 Et la pose s[o]us la prochene.
 Après resoit par tai posee
 Tel figure après la doublee
 480 Qui la mouteplit une fois,
 Et soi après, quer ch'est drois; fo. 16 b
 Et la soume qu'il mousterra
 Desus au nonbre osté sera.
 La figure qui est posee
 485 Après, si soit par toi doublee;
 Et bien saches que ele doit estre
 Posee eu prochain lieu vers destre.
 Chascune figure posee
 Devant atrei vers la doublee;
 490 Et s'ilec treuves unité
 Qui viengne de duplicité,
 Yccelle figure adente
 La figure que est precedente;
 Et si la pose eu premier lieu
 495 Qu'après ches figures iert veu.
 Tel figure que est precedente
 Et en soi a tel sens adente
 Quer le nonbre desus tantost
 Tout autant con en porra ost
 500 Des figures en tel maniere,
 Tout sans müer la premiere,
 Le nonbre ou riens ne remaindra
 Desus cele quarte sera,
 Et s'il i met aucune chose,
 505 A une part par soi le pose.
 Quant ta rachine traite aras
 Issi, après medieras

last figure set one which when multiplied by itself will forthwith take away the whole of the number above it, or at least as much as it can; and when the figure above is taken away, cancel it at once. Next double the under figure, move it towards the right, and place it under the next. Then see that you place after the doubled figure another which will multiply it once [without exceeding the number above], and itself as well, for that is the correct procedure; and the total that results [from its multiplying the doubled figure and itself] must be taken away from the number above. Next double the figure which is placed after; and take note that it must be placed in the next position on the right. Draw towards the doubled figure each figure that is put in front; and if you find it [i.e. the doubled figure] to contain a one as a result of the doubling, that figure [i.e. the one] overthrows [i.e. increases by one] the preceding figure; put it then [i.e. the added figure, without the one] in the first place that is vacant after these figures. Overthrow any figure which precedes and is of such a nature (?) that it may forthwith take away the number above, so far as it can of the figures in this manner, without altering at all the position of the first The number in which nothing remains will be above that fourth figure, and if there is any remainder (?), place it on one side by itself. When you have thus extracted your root, you must next halve your under number,

469. *Ms.* liuitisme. 472. *corr.* el ?; porra] *Ms.* Pra (=parra ?) 476. or l'amaine ? (but cf. 430). 477. *Ms.* p'chene. 478. Et expuncted before Après. 479. Tel] A cele; final e of doublee added by B. 480. A mouteploier. 481. *Ms.* soit. 485. Et expuncted before Après; soit] A doit. 487. *Ms.* p'chain. 489. A ratroi, r expuncted. 490. A Et cil est troues; *Ms.* vnites. 491. A maigne. 493. que] *Ms.* qi corrected to q̄. 495. *Ms.* veue. 496. *Ms.* precedentes. 497. *Ms.* atendes corrected to adentes. 498. *corr.* Que ? 500. A an maniere. 501. *corr.* remüer (cf. 362, 452) ? 504. i met] *corr.* i maint or remaint ? 506.r

Ton bas nonbre sans la figure
 Premiere, et saches a droiture
 510 Que icel bas nonbre iert la raïz;
 Et ne soies pas esbahis.
 Se veus prover se bien as fet
 Et ta rachine en droit se trait,
 Mouteploie la maintenant
 515 Par soi, et che que est remanant
 De la quadracion ajouste
 O tel nonbre; par itel jouste fo. 16 c
 Verras le nonbre, si te haite
 Se a droit ta raïz as traite.
 Explicit.

of traite corrected from a. 509. *A* premier; *Ms.* sachiez. 510. *Ms.* Que ii cel;
z of raïz added by B. 515. *A* Pra. 516. *Ms.* Dae, a expuncted. 519. *Ms.*
Et se; Ms. adroite, e expuncted; A taras atraite.

omitting the first figure [of each pair], and be well assured that that under number will be the root; and do not feel bewildered. If you wish to test whether you have calculated properly and your root is correct, multiply it forthwith by itself, and add to the resulting number what is left over from the quadrature; on putting them together thus, you will see the [original] number. Then be joyful, if you have extracted your root correctly. Explicit.

WORD-LIST.

[References are given for all technical terms, for words, meanings and phrases of lexical interest, and for a few words and forms requiring special explanation. Square brackets indicate that an emendation has been introduced. An asterisk indicates that the word or meaning is not mentioned in the dictionaries of Tobler-Lommatzsch (down to *co-*) or Godefroy (from *co-*).]

aconte, *sm.* reckoning, calculation 13, 50, etc.

aconter, *v.a.* 73.

acoster, *v. refl.* (÷ *a*) come close to, encounter 214; (÷ *de* and *inf.*) 203; cf. *apoier*.
addition 88, *adiciun* 221, *-ion* 227, *sf.*

adenter, *v.a.* put face downwards, overturn 108, 492, 497.

agenchier, *v. a.* set in order 408.

ajoster, *-ouster*, *v. a.* (+ *a*) place next to 182, (+ *ou*) do. 291; add 181, 190, etc.

**ametre*, *v. refl.* (÷ *a*) set oneself to, undertake [3], [333]; Godefroy gives a single example of this use, but constructed with *de*.

anonchier, *v.* 296.

apoier, *v. refl.* (÷ *a*) come close to, encounter 351.

**apost*, *adj.* unpleasant, disagreeable (= *empost*) 171.

argorisme, *sm.* 4, 7, 53, 150, etc.

arismetique, *sf.* 43, 78.

**article*, *sm.* number completely divisible by ten 140, 151, 156, etc.

asuer = *as(s)coir*, *v. a.* 343.

astronomie, *sf.* 43, 64.

atint, *pret.* 3 *sg.* of *atendir*, *v. a.* attain, grasp, comprehend (confused with *ataindre*
cf. Tobler-Lommatzsch, I, col. 635) 6.

atrei, *imperat.* 2 *sg.* of *atraire*, *v. a.* 489.

aüner, *v. a.* assemble 68.

**autretans*, *adv.*; *par a.*, an equal number of times 440.

**avoisdier*, *v. refl.* (÷ *a*) acquire skill in 306.

betorner, *v. a.* turn the wrong way 104.

**centisme*, *s.* a hundred 128; an error for *centaines*?

chifre 143, 256, 262, 289, *cifre* 145, 242, etc., *sifre* 210, *sm.* cypher, ngught.

chil, *sm.* pair of eyebrows 104.

**cience* = *science*, *sf.* 23; cf. *escience*.

conpost, *-ot*, *sm.* composite number consisting of article and digit (Lat. *compositum*) 151, 161, 197, etc.

conpot, *sm.* explanation of ecclesiastical calendar (Lat. *computum*) 2, 5, 9, 22

63, 65, 71.

controubler, *v. refl.* 283.

crisme, *s.* fear 8.

croche, *sf.* 109.

dejouste, *adv.* 370.

dejus, *adv.* 240, 438.

départir, *v. a.* [36], 324.

descriënt, *ind. pr. 3 pl.* of *descri(v)re*, *v. a.* 34.

devisant, *pres. p. as adj.*; *le d. nonbre*, the divisor 428; *sm.* divisor 445.

**devisé*, *sm.* divisor 431; corr. *devisant* ?

deviser, *v. a.* divide 35, 427, etc.

**disime*, *s.* ten 127, 160; an error for *disaine(s)* (*cf.* 157, 244) ?

division, *sf.* 90.

**doi*, *sm.* digit 151, etc.

dotrine, *sf.* 53.

dotrinel, *adj.* theoretical 48; *cf.* Lat. *scientia doctrinalis* (Isidore, quoted by Lewis and Short).

double, *sm.* 279.

doubler, *v. a.* 274, etc.; *dis d.*, increase tenfold (corr. *par dis* ?) 131.

**doubloison*, *sf.* 89.

duplicité, *sf.* doubleness 491.

enchiés, *adv.* 212, 257.

enconbre, *sm.*; *faire [a] la plache e.* 138.

endroit, *prep.* next to, against 367.

enduire, *v. a.* teach 394.

escience, *sf.* 48.

esfachier, *v. a.* 378.

espece [64], 78, 86, 92. *-ese* 459, *sf.* subdivision, (arithmetical) operation.

estance, *sf.* 365.

esteuche 214, *estueche* 351, *subj. pr.* of *estouvoir*, *v. impers.*

estrere, *v. a.* take away 223.

[*estreindre*], *v. refl.* 231.

eustration (de radix), *sf.* 91; corr. *extr-* ?

faucille, *sf.* 103.

fïee 395, *fïe* 443, *sf.* time.

figure, *sf.* 94, etc.

finable, *adj.* capable of ending, divisible 160.

flabe = *fable*, *sf.* 159.

foi, *imperat. 2 sg.* of *faire* 210.

fructefier, *v. n.* 141.

game, *sf.* gamut, scale 62.

geometrie, *sf.* 44.

gramere, *sf.* 39.

haitier, *v. refl.* 518.

haster, *v. a.* 2!

jouste, *sf.* juxtaposition 517.

logique, *s.* 39.

maine, *imperat.* 2 *sg.* of *mener*, *v. a.* 430, 476.

matematique, *adj.*; *art m.* 46; *s.* 47.

mediation, *sf.* 89.

medier 307, 323, 507, *-ier* 313, *v. a.*

mencion, *sf.*; *faire m. de* 347.

**mener*, *v. a.* multiply 470; similarly in the algorism published by V. MORTET (Bibl. Mathematica, 3d series, 9, 1908), p. 62 : *li digis soit menés en soi cument* (Lat. *ducatur in se*); cf. Eng. *lead* (New Eng. Dict.).

mespraigne, *subj. pr.* 3 *sg.* of *mesprendre* 72.

mesprison, *s.* mistake 178.

metié = *moitié*, *sf.* 315.

mi-partir, *v. a.* 317.

monter, *v. n.* amount 49.

**mouteploiant* 348, *-pleant* 357, 360, *sm.* multiplier.

**mouteploie*, *s(f?)* multiplication 90.

mouteploier 329, etc., *-ploër* 358, 401; *subj. pr.* 3 *sg.* *-plit* 480 : *v.*

multepleanche 363, *-ance* 364, *sf.*

multeplioier, *v. a.* 366.

multiplicacion, *sf.* 346, 381.

musique, *s.* 44.

naturelment, *adv.* easily (?) 76.

nient, *sm.* naught 135.

nonper, *adj.* odd 313, 464, 468.

nonsavoir, *sm.* 28.

novenere, *adj.* consisting of nine units; *used as subs.* 263.

oël, *adj.* equal 241; cf. *egaux* 238.

of, *sm.* egg 109 A.

orine, *s.* origin 54.

par, *prep.*; *p. soi*, independently, separately 167, 216, 405, 470.

penultime 356, *peleultisme* 365, 466, *-ime* 436, *adj.*

per, *adj.* even 465, 466.

philosophe, *sm.* 34.

portraire, *v. a.* indicate 447.

pose, *adv.* for a while 448.

precedent, *adj.* 493, 496.

*[*primeranier*], *adj.* first 186.

principal, *adj.* 33.

progression, *sf.* 147.

**quadracion*, *sf.* 516.

quadrucie, 38, 42, 45, 52, *-uve* 49, 55, *sm.*

*[*quarreson*], *sf.* squaring 460; cf. *quadracion*.

quasser, *v. a.* cancel, suppress 474.

rachine, *sf.* 506, 513.

raiz, *sf.* 463, 510, 519; cf. *radix* (Lat.), 91.

remaindre 220, 502; *ind. pr.* 3 *pl.* -aignent 289, [399]; *pres. p.* -anant 515 : *v. n.* be left; *pres. p. as subs.* remainder 420.

remuer, *v. a.* change about 362, 452; cf. *müer* 501.

reposer, *v. refl.* cease, stop 449, 468.

respondre, *v. n.* correspond 188.

rethorique, *s.* 40.

roont, *adj.*; * *en r.*, taken together, in conjunction 402.

roumans 2, 4, *rom-* 75, *sm.* the vernacular, French.

saut (de la lune), *sm.* 67; cf. Beda, *De Temporibus* (in Migne's *Patr. Lat.*, xc), cap. xii, *De Saltu Lunae*, and Philippe de Thaün, *Cumpoz*, ed. Mall, vv. 2345 ff.

savoir, *inf. as conj.* to wit, namely 434; cf. W. Foerster, note to Crestien's *Lancelot*, v. 2846.

sens, *sm.* intelligence 30, 31, 328; manner 36, 71, 95, 179, 314; nature 49 (?), 497 (?); position 312 (?).

sentence, -*enche*, *sf.* nature 97; manner 396.

**serer*, *v. a.* reduce (?) 250; corr. *resereras* ?

**sofe*, *s.* sol-fa, notes of music 62.

soit, *ind. pr.* 3 *sg.* of *savoir* 13, 273.

soustraire 233, etc., -*ere* 262, etc., *soutraire* 437, etc.; *imperat.* 2 *sg.* *soustroi* 19 : *v.*

subtraire, *v. a.* 230.

subtraction 88, -*acion* 222, 228, 270, *sf.*

sus, *prep.*; *contenir s. soi* (corr. *sous* ?) 40.

tenir, *v. a.* contain 42.

tenor, *s.* manner 226.

totedi, *adv.* 102.

traire, *v. a.* extract 506, 519; *soi t. en droit*, be correct 513

translater, *v. a.* 1, 74.

**trespousser*, *v. a.* push aside 206.

trive, *sm.* trivium 37, 39.

trover, *v. a.* invent 52, 80.

ultime 338, -*isme* 339, 438, 469, *adj.*

unité, *sf.* unit 126, 285, etc.

veu, *adj.* empty, vacant 495; probably a dialectal form of *vuit*, cf. *veut*, *veude*, *veudier*, quoted by Godefroy; for the fall of the *t*, cf. O. Fr. *vuier* by the side of *vuidier*.

visde, *s.* craft, cunning 30.

voier = *veoir*, *v. a.* 166.

Argorisme 79, 81; cf. L. C. Karpinski, Robert of Chester's Latin translation of the Algebra of Al-Khowarizmi, New York, 1915, p. 13.

[*Donnet*], Donatus, Latin grammar 60.

Grece 77.

Ysidre, Isidore 14, 21, 27.

(Oxford)

E. G. R. WATERS.

The Teaching of Elementary Geometry in the Seventeenth Century.

Almost the sole source of information obtainable in this investigation is the supply of textbooks left us from that period. Unquestionably this fact renders achievement in the study more difficult. But the handicap is not as great as might at first be supposed. This is true, first, in view of the fact that there is available an abundance of texts used in the seventeenth century, and, secondly, because the large majority of these are from the pens of the most prominent and influential teachers of that period. We shall now consider these points more in detail.

THE TEXTBOOKS.

A survey of the works in a number of libraries (1) of the United States which are rich in this material discloses the fact that there are approximately two hundred different texts extant on seventeenth century geometry. The reader will find about one hundred seventy-five of these listed in the bibliography, which does not give many of the editions of EUCLID's Elements published during this century (2). Writings on the subject appeared in all of the chief vernacular languages of that day, as well as in Latin. The number of Latin works, however, is considerably less than was the case in the preceding century, and those which were printed in this language were in the main editions of productions that first appeared in the sixteenth century. Not counting the different editions of each, there are among the books examined in the preparation of this paper about a dozen works in the German language, and a like number in English; approximately two dozen each of French, Italian and Latin; and about a half dozen Dutch volumes.

* (1) See the author's checklist in *Isis*, 10, 21-32 for complete titles of works briefly referred to here.

(2) HEATH : « Euclid », v. I, ch. VIII.

The writing of texts in Germany during this time was doubtless cut short because of the destructive influence exerted upon the schools by the Thirty Years War. Due to the fact that England held much longer to pure Euclidean Geometry than did any of the continental countries, we do not find so many independent English texts. Great productive activity marks this period in France and Italy. Such French works as those of LAMY (3), ARNAULD (4) and L'E CLERC (5) met with general approval and were given wide recognition. The texts of some of these French writers were highly appreciated by students of other nationalities, as is proved by the number of foreign editions of their works. Italian textbooks of this century are devoted almost entirely to the applications of geometry. Thinking of the works as divided into groups according to the languages in which they appeared, the Italian group is by far the most practically inclined of the seventeenth century.

Not much is definitely known about which of the above texts were used, nor to what extent geometry was taught, in the early period of the American Colonies. There are, however, indications that those who were interested in the pursuit of mathematics found it possible to provide themselves with books. We are told that geometry was one of the courses of study offered in Harvard College in 1642 (6). We know furthermore that in 1659 some mathematical books were given to the library of Harvard College (7); that geometrical instruments were used at this early date (8); and that friends in England were desirous of supplying the colonists with works on mathematics (9). The two works of NORWOOD, «Trigonometry», 1631, and «Epitome of Navigation», 1667, were early used in the colonies. The latter work was one of the books ordered by SAMUEL SEWALL in the year 1700 (10) while the former is listed among the titles of a colonial library of the last quarter of the seventeenth century (11). Some of the NORWOOD books contain

(3) « Les Elements de Geometrie », 1685.

(4) « Nouveaux Elemens », 1667.

(5) « Pratique de la geometrie », 1669 and « Traité », 1690.

(6) T. G. WRIGHT : « Literary Culture in Early New England », Yale Univ. Press, 1920, p. 19.

(7) *Ib.*, p. 42.

(8) *Ib.*, p. 49.

(9) *Ib.*, p. 72.

(10) *Ib.*, p. 119.

(11) *Ib.*, p. 130.

preliminary material on geometry. For example, the 1685 edition of MATTHEW (son of RICHARD) NORWOOD's « System of Navigation » devotes the first chapter to a discussion of geometrical principles, in which thirteen problems of construction of the usual sort are treated. CAJORI tells us that the printed work of ALSTED (12) is known to have been used in 1726, and may have been used earlier (13). Coupling with this the statement in the diary of INCREASE MATHER for the years 1675 and 1676 to the effect that he read a book by ALSTED (title not given) (14), it becomes all the more likely that this text was used in the colonies in the period in question. There were also other books on mathematics used. In 1693, sixty-one works on mathematics and astronomy were offered for sale in Boston. Forty-eight of these were in Latin and the remainder in English (15). But, with all of this, we know that no professorship in mathematics was established in William and Mary College until 1711, and in Harvard College until 1727 (16).

THE AUTHORS.

Before a true estimate of the value of these works as textbooks can be made it is highly important to know about their authorship. We find that an overwhelming majority of the writers were outstanding teachers of their day. Among the authors referred to in the checklist published by the present writer in *Isis*, 10, 21-32, we list the following with their occupations : 1. CLAVIUS was a Jesuit of considerable ability. His contemporaries called him « the Euclid of the Sixteenth Century ». He was a successful teacher in Rome for twenty years. 2. MILLIET DE CHALLES, also a Jesuit, was « professeur royal d'hydrographie à Marseille », taught also in the « collège de la Trinité », Lyon, and later was called to teach at Turin, where he died shortly afterwards. 3. HOFMANN was the first professor of mathematics in Helmstädt and at later dates taught also in Marburg and Jena. 4. METIUS was a teacher in the University of Franeker for many years. 5. The Jesuit PARDIES

(12) First edition, 1613.

(13) « The Teaching and History of Mathematics in the United States », p. 23.

(14) WRIGHT : « Literary Culture in Early New England », p. 130.

(15) *Ib.*, p. 127.

(16) *Ib.*, p. 171. Also SIMONS : « Introduction of Algebra into American Schools in the Eighteenth Century » 1924, p. 4.

likewise was a teacher in various places with special success in Paris. 6. It is well known (17) that PETER RAMUS, one of the best pupils of FINAEUS, distinguished himself as a teacher both of philosophy and mathematics. 7. LAMY taught in three different schools and gave much thought to the general principles of teaching. The last eighty-two pages of his work, « Les Éléments de Géométrie », are given to a treatment of method in study. This will be discussed later. 8. TACQUET gave fifteen years of his life to teaching. 9. WILLIAM LEYBOURN divided his time between giving instruction and acting as a professional surveyor. 10. The one Spanish work listed was written by ZARAGOÇA, a Jesuit teacher of scholastic philosophy in the earlier part of his life and of mathematics in Madrid the latter years of his career. Likewise, 11. ROHAULT, 12. BLONDEL, 13. RECORDE, 14. GAUTRUCHE, 15. ALSTED, 16. BOURDIN and many others were teachers.

Among the few who were not teachers by profession may be named : 1. STEVIN, who was at different times book-keeper, revenue officer and inspector of dykes, but who was in spare time the private instructor of Prince MAURICE OF NASSAU ; 2. BEUTEL spent much of his time in secretarial work. 3. ARDÜSER, 4. ERRARD and 5. RUDD were engineers.

Thus we see that, having at our disposal the numerous works still extant, nearly all of which are the direct outcome of the classroom experiences of great teachers, a careful study of these books will convey to us not only much about the order of presentation of material, but also will give certain information as to their motivation in teaching and even reveal something of their methods of class-room instruction.

MOTIVATION — PURPOSEFUL INSTRUCTION.

In discussions given at the present time on the aims of mathematical instruction, the arbitrary classification into three groups is customary. Our first emphasis is now placed upon the utility of the subject. Besides this there are those who do not tire of pointing out the value of the teaching of mathematics from a disciplinary point of view, while others stress its cultural value (18). Something

(17) GRAVES : « Peter Ramus ».

(18) « Reorganization of Mathematics », pp. 6-12.

can be said in favor of each of these classes of aims. It is, of course, to be understood that these divisions are more or less artificial and that in reality any one is not all exclusive of the others. But for convenience we shall retain these three classes of aims in our treatment of seventeenth century geometries.

1. UTILITARIAN AIM.

Never in the history of geometry has there been a time when more emphasis was placed upon the utility of the subject than in this period. In fact almost all of the works display a strong tendency toward the practical. Even those authors who do nothing more than select for their texts material from EUCLID sometimes make it a point to show the uses of the propositions which are given. Thus we find that the work of BRUNN (19) contains only those parts of EUCLID which the author thinks are of more practical value. These are, chiefly, constructions. REEVE WILLIAMS (1685) who translated the geometry of DE CHALES entitled the book « The Elements of EUCLID, explained and demonstrated in a New and most easie method. With the uses of each proposition in all the parts of mathematicks. » For example, on page 204 of this work is found proposition XVI of Book IV : « To inscribe a Regular Penta-decagon in a Circle. » After showing how the construction is done, he gives the following « Use » : « This Proposition serveth only to open the way for other Polygons », etc. Occasionally he omits a proposition altogether, stating that it is unnecessary. The same plan is followed by the later work of WELLS who, in the preface of his work (20), says, « I have not only subjoin'd to the several Theorems relating to Lines and Planes some of their Uses, but have also illustrated the same by Examples, relating to taking Heights and Distances, or to Surveying, etc. ». On page 206 he writes, « Of any Triangle ABC, one side BC being produc'd, the extern Angle ACD, is equal to the two intern and opposite A and B. And consequently, all the three intern Angles, viz. A and B, and ACB, are together equal to two Right. » After demonstration he says, page 208, « Besides the great Use of this fourth Theorem (and its Corollaries) in demonstrating other Propositions, on it more immediately depend several Particulars of great Use in Prac-

(19) « Euclidis Elementa Practica », 1625.

(20) « The Young Gentleman's Arithmetick and Geometry », 1723.

tice, some few of which I must be content here to take Notice of ». He then proceeds to show its use in the method of 'taking the height of an object by the quadrant and the method of finding the sum of all the angles in any polygon.

The only reason given by LEYBOURN (21) for learning geometry is utilitarian : « The Utility and Benefit of this most excellent Art, is of such importance, that without it we can scarcely live, much less preserve ourselves from danger, or hinder the irruption of foreign Enemies; for by the Rules hereof the Geodetian may measure, plot, and give you the true Symetry, Situation, and superficial Content of your Lands; search out all manner of Highths, Depths, and Distances, whether they be accessible or inaccessible : The Military Architect may hereby fabricate his Fort. The General, or Major, embattail his Army : The Quarter-master order and set out his Quarters, and incamp his Soldiers : The Engineer plant his cannon, convey his Mine to any assigned place under the Ground, to doe execution upon his Enemy to their greatest disadvantage. » He continues, pointing out that the benefit of geometry does not end « in these terrestrial practices », but also « extendeth to the Mensuration of the Celestial Bodies ».

Everywhere in these works one is reminded of the thorough familiarity of the authors with the applications of geometry. This led them to a choice of text material that entered into the experiences of the average person. Thus PHILIPPE NAUDÉ lists in his preface the purposes he had in writing the book. He states, among other things, that earlier German works presented their material in such an unnatural way that the beginner found it exceedingly difficult to use it (22). He must have had some notion of the very thing upon which we are now so strongly insisting (23), namely, that mathematics be presented in such amount and manner as will meet the needs of the student as he is confronted by the social, scientific, industrial and political problems of every-day life.

(21) « *Cursus Mathematicus* », 1690, p. 205.

(22) Ed. of 1706. « Endlich brauchen sie auch viele solche Redens-Arten/ welche von dem gemeinen Gebrauch im Reden so weit entfernt/ uns so unnatürlich scheinen/ dasz sie bei denen Anfängern/ nicht anderst als mit groszer Mühe können gebraucht werden ».

(23) « *Reorganization of Mathematics* », pp. 6, 7.

2. DISCIPLINARY AIM.

There was no doubt in the minds of seventeenth century writers as to the possibility, or even inevitability, of the « transfer of training » received by the mind in mathematical studies to other fields of endeavor (24), although this aim in mathematical teaching was secondary to the utilitarian view already mentioned. Many of the writers stress in their prefaces the disciplinary value of the subject. A typical example will be sufficient to give the point of view generally held. The author of « The Elements or Principles of Geometrie », writing on demonstration on the first page of his introduction, says that « nothing is so apt (as demonstration) to strengthen our Reason, to give us a clear notion of things, and secure us from being imposed upon by fallacies or shadows of proof, as conversing herein. — He must not leave it, (the demonstration) till all be as clear as if writ with a beam of the Sun. And though some of the Theorems may not be of such universal use as others, yet all will be profitable to perfect the Mind and Reason, when they are thus clearly apprehended ».

3. CULTURAL AIM.

Nor were these writers unmindful of the cultural effects of the study of geometry. Due recognition is given to the value of the subject in cultivating in the student a higher sense and appreciation of beauty. BEUTEL brings this out most admirably in the preface of his « Lust-Garten », edition of 1729, where he points out the value of geometric proportion to the artist in his work of beautifying the world. After other arguments he finally concludes that, were we compelled to dispense with geometry, we should have to live among one another in confusion and impropriety as do the rudest Indians. (25) Even the title of his book brings out his appreciation of the esthetic value of the study. The fact that Beutel wrote also a work on « Mathematische Schönheit » attests further the attitude of cultural appreciation.

Among others, EDWARD WELLS, rector of Cotesbach in Leicestershire, sees in the study of mathematics the means of raising the

(24) *Ibid.*, p. 90.

(25) 1729 ed., pref. « In Summa, wenn wir nechst Gottes Wort die edle Künst Geometriam nicht hätten, so würden wir eben in solcher Confusion und Ungeschicklichkeit unter einander leben, wie die rauhest Indianer. »

mind « to more clear and sublime Apprehension of his (God's) Divine Perfections » (26). « For », he writes, « we are assured (27) by the wisest of Men that GOD has order'd all Things in Measure, Number, and Weight, that is, according to the Rules of Mathematicks : And therefore, He that would rightly apprehend the Excellent Order or Contrivance of the Creation, must first understand the Sciences relating to Measure, Number, and Weight, that is, the several Parts of Mathematicks ».

Thus we see that the geometers of the seventeenth century were in surprising agreement in their aims with the statement of the National Committee on Mathematical Requirements (28) « The primary purposes of the teaching of mathematics should be to develop those powers of understanding and of analyzing relations of quantity and of space which are necessary to an insight into and control over our environment and to an appreciation of the progress of civilization in its various aspects, and to develop those habits of thought and of action which will make these powers effective in the life of the individual. »

METHOD OF PRESENTATION OF MATERIAL IN THE TEXTS.

I. SYNTHETIC AND ANALYTIC METHODS.

In all of the history of geometry one method of presenting the material of the subject in the textbooks has overwhelmingly overshadowed all others. This method is the synthetic. It is the predominant method of the seventeenth century. This is obviously true because the synthetic presentation has something to recommend it. A few points will be considered.

It is very advantageous to the geometer who would emphasize logical exposition. The logician feels himself secure when, and only when, he can proceed with sure and direct step from the known to the unknown. Because there have been in every century since the day of EUCLID those who stressed logic, the synthetic method has retained its high place in the texts.

(26) See his preface. See also « Reorganization of Mathematics », p. 10.

(27) Here he cites Wisdom of Solomon, Chap. II, v. 20.

(28) « Reorganization of Mathematics », pp. 10, 11.

Brevity is another outstanding advantage of the synthetic method. Were it not for the fact that nearly all theorems are proved synthetically in the texts, works on geometry would of necessity be much larger and more cumbersome than they are. If the chief interest of the reader is to obtain a formal, concise, beautiful proof, he would always prefer the synthetic statement.

Students of the seventeenth century recognized — as those of other ages also have — that in mathematics is to be found more clearly presented than in any other subject of study a distinctly characteristic type of human thought which every civilization of the world has of necessity appropriated to its own needs. The mode of thought of mathematics, and of geometry in particular, leads the thinker to the drawing of conclusions which are in themselves certain, which lead to other certain conclusions, and which are found « in human intercourse in general » (29). The synthetic method of presentation more clearly than any other brings out this certain progress from conclusion to conclusion.

As one writer of the present time has put it, « for formal statements of proofs obtained, for their permanent record, for summaries, for reviews, the synthetic method is invaluable in the class-room (30).

On the other hand, there is very often an obscurity of explanation in connection with the brief and beautiful synthetic proof which leaves with the learner a sense of helplessness. The method of attack is missing. This fact has led to a rather strange state of affairs in geometry. While the textbooks have been synthetic, the analytic method of presentation has had the preference. The same author just quoted above (31) says that « there is no question that the atmosphere of the mathematical class-room should be analytic from the primary school to the University ».

This appreciation of analysis is much in evidence in the works of this study. The analytic method of attack was unquestionably widely used in teaching, although, as now, not frequently seen in texts. That the distinction between these methods was clear to seventeenth century writers is assured us by the fact that even

(29) J. W. A. YOUNG : « The Teaching of Mathematics in the Elementary and the Secondary School », 1906, p. 19.

(30) *Ib.*, p. 56.

(31) *Ib.*, p. 56.

EUCLID's Elements both defines and illustrates these terms (32). Furthermore, PAPPUS explains quite fully and clearly the two processes. The following quotation gives in part the account of PAPPUS : « Analysis then takes that which is sought as if it were admitted and passes from it through its successive consequences to something which is admitted as a result of synthesis : for in analysis we assume that which is sought as if it were (already) done (γεγονός), and we inquire what it is from which this results, and again what is the antecedent cause of the latter, and so on, until by so retracing our steps we come upon something already known or belonging to the class of first principles, and such a method we call analysis as being solution backwards (ἀνάπαλιν λύσιν) » (33).

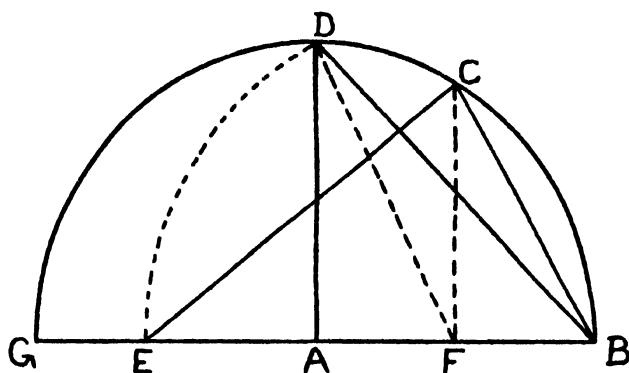
There is among the works of this period one text that differs most widely from all the rest in that it gives a full book to the subject of method. This is the « Elemens » of LAMY (34). This work is composed of five books, the last of which has thirteen chapters, as follows : « Chapitre Premier. L'on peut déduire des Elemens qui ont été expliquez ci-dessus, tout ce qui se peut sçavoir de Geometrie, lors qu'on suit une bonne methode. » In this chapter he explains that in the preceding four books of his work he has by no means said all that might be said on the three dimensions of bodies, but that many other propositions might be deduced. He calls attention to the need of independent effort on the part of the student and the comparison of the results of such efforts with the works of great men to see wherein he lacks. He mentions ARNAULD as one author who treats some theorems more fully than he himself does. Finally he considers some problems on the section of triangles. « Chapitre II. De la methode qu'il faut suivre dans l'examen d'une question » The chief point of this chapter is that the student must practice concentration of the mind. « Chapitre III. Il faut premierment, éclaircir une question. En second lieu retrancher ce qui ne feroit que l'embarrasser, et suppléer les choses qui la rendent plus claire. On doit employer des termes propres pour l'exprimer. » That is, the question must first be clear, the confusing part eliminated, other things supplied which will render it more intelligible, and correct terms of expres-

(32) Bk. XIII, 1-5

(33) HEATH : « Euclid », v. I, p. 138.

(34) 1685, pp. 255-336.

sion must be employed. By this he means the use of good figures, convenient notation and the like. To illustrate, he considers this exercise :



« We say that if BC is equal to the radius AB , BD is the chord of 90 degrees, and CE is taken equal to BD , then the line ED will be the side of the regular inscribed pentagon in the circle of which AB is the radius. The question is to determine whether this is true or false. » (35) After answering the question with considerable detail he adds : « Remarquez bien que ce qui nous a facilité la démonstration précédente, c'est que nous avons éclairci la question, et donné des noms convenables aux lignes proposées, ayant nommé $2a$ le rayon du cercle. L'éclaircissement d'une question consiste souvent à faire une figure qui l'exprime bien. » (36) It sounds very much like what a teacher would tell his class today.

« Chapitre IV. Ayant supposé la chose que l'on cherche, telle qu'elle doit être, en considérant les propriétés qui lui conviennent l'on connoît si ce qu'on propose est possible, et le moyen de résoudre la question. » The sense of this chapter is as follows : After the figure has been drawn according to the proposed problem, one must consider the properties which follow from the supposition and the construction of the figure. It may be that the problem will be seen to be impossible of solution. If not, one must consider

1. what is known about the properties appertaining to the figure,
2. what is known about the angles involved, by which ratios

(35) *Ib.*, p. 267.

(36) *Ib.*, p. 268.

between certain lines may be established, and 3., this much having been done, one passes from « knowledge to knowledge ». Finally, 4. he calls attention to the proportionality theorems in connection with similar triangles (37). Examples are given as in previous chapters.

« Chapitre V. Les principales Regles de la Methode. » He gives eight of these principal rules of method, which are, in substance, as follows : 1. Not all being unknown in a question, we obtain enough to represent the thing in question, suppose it done as requested, and begin with that. 2. As soon as a question is proposed we can tell if the required construction is dependent upon our choice of certain magnitudes, and consequently if it is determined or not. 3. We must study with care what is required in a question and distinguish the unknown from the known. 4. We discover in a question the value of an unknown magnitude by the properties of the figure which has been made for the problem, and by the known relations between the unknown and known magnitudes. 5. Upon examining what the known relations are of which the proposed problem speaks, we devise a way of expressing them in two manners, i.e., in the form of an equation. 6. The different terms of the equation should be expressed, if possible, so as to involve only one unknown letter. 7. Having an equation or a double expression, in which there is but one unknown, we must treat it so as to get the unknown on one side of the sign of equality and the known on the other. 8. Reduce the terms of the question to the simplest form. As before, ample explanation and illustration is supplied with each rule (38).

« Chapitre VI. Les Problèmes que l'on entreprend de résoudre par l'ordre qui est ici expliqué, et que nous avons appelé ailleurs Analyse, se distinguent en certaines classes : ils sont ou lincaires, ou plans, ou solides. » After discussing these types of equations (linear, quadratic and cubic), he takes up in the remaining seven chapters, among other things, their solution, the method of some particular problems and the possibility of solving them with ruler and compass.

Through all of his work we find evidence of an unusually clear mind and an easy yet thorough method of dealing with even the

(37) *Ib.*, pp. 273, 274.

(38) *Ib.*, pp. 282-288.

more abstract subjects. According to the testimony of his works, Lamy was a man of great learning and a teacher of extraordinary power.

2. PEDAGOGICAL APPROACH.

Considering the texts of seventeenth century geometry in the light of the present, as we of necessity must, the question of the organization of material is one of deep concern. Today we want the subject matter to be challenging to the interest and ingenuity of the student, practical not only in the sense of its being usable, but also in that it fits well into the various situations of human interest, and organized in such manner that there will be a pedagogically reasonable approach to the formal geometry. We feel that the teaching of geometry has long enough been laboring under the burdens of tradition and that there is no necessity of the subject being made one of unusual difficulty but rather that it can be taught and taken not only painlessly but with pleasure.

Much of this can be made possible by properly selecting and arranging the material. That this is considered important by writers of the present is seen in the fact that in ten of the leading geometry texts of today there is an average of more than twenty-five pages of informal preliminary geometry before the formal part is taken up. Instead of offering to define precisely such terms as point, straight line, magnitude, space, plane, surface, distance, direction and solid, writers now discuss them informally. (39) There is, furthermore, no hesitation on the part of writers to put into their geometries what once would have been considered as belonging strictly to books on algebra, trigonometry or other subjects. The algebraic or any other method of analysis is used with freedom. Material is organized to harmonize with the way in which the students learn most naturally. The formal, logical presentation of all elementary mathematics must yield to the psychological.

Seventeenth century texts do not, of course, come fully up to our present ideals from a pedagogical point of view. Their authors could not take into account the findings of psychology when that science was unknown as such. But they did surprisingly well. Many of them, it should be recalled, were philosophers as well

(39) "Reorganization of Mathematics", p. 75.

as mathematicians, and philosophy is the mother of psychology. At any rate, numerous good pedagogical principles are found in the geometries of this study. Recalling, as the author has already done in an earlier article in *Isis*, that at the beginning of the century two distinct branches of geometry, theoretical and practical, were recognized, and that in the last quarter of the century a combination of the two was effected, it will readily be seen that with the exception of the present day no more opportune time was ever presented in the history of geometry for a thorough reorganization of the subject-matter.

A considerable number of the authors of the period make statements in title, preface or elsewhere, indicating clearly that a dominant aim of the century among textbook writers was the presentation of material in such manner as to make it more easily taught and learned. Thus in giving reason for the particular divisions of his work, HOFMANN writes that he did it for the sake of better teaching (40). BOURDIN stresses clarity of representation by figures in order to save the student time and difficulty : « Le cours de mathématique, abrégé et clairement représenté par figures, en faveur de ceux qui veulent apprendre les Mathématiques en peu de temps, et sans peine. » (41) Men were then, as they are now, seriously searching the horizon to find new and better teaching points.

3. PRELIMINARY MATERIAL.

A wide range of preliminary material is found in these works. The following topics are variously treated : 1. Introduction of Terms. 2. Acquaintance with Axioms and Postulates. 3. The Use of Geometry. 4. Use of Instruments in Construction. 5. Introduction of Symbols. 6. Acquaintance with Geometric Forms. 7. Historical Sketch. 8. A Bibliography. 9. The Relation between Geometry and Other Branches of Mathematics. These topics will now be taken up in some detail.

a. *Introduction of Terms.*

It has been stated that definitions are present in great number. But they have neither the formal character of the definitions of EUCLID's *Elements* nor of those in nineteenth century geometries.

(40) Ed. of 1853, p. (5), « umb besser Unterrichts wegen ».

(41) Ed. of 1861, p. 4.

Terms are discussed rather than defined in some works, while in others they are discussed and explained after having been defined. The only lack of freedom with regard to the introduction of terms is in connection with the place given them in the book. Sometimes all definitions are printed together. The works of GRUBER (42) and ERRARD (43) may be mentioned as examples. Others introduce the definitions only when needed. An excellent example of this is the already much quoted book of LAMY. He has nowhere a large number of definitions together. There is a general mixture of theorems, corollaries, postulates, lemmas, scholia, definitions, each being introduced as needed. This is a point now considered as one of pedagogical value.

b. *Axioms and Postulates.*

Mention has already been made of the number of axioms and postulates contained in these works. Writers were free to use as many as seemed convenient to them. Tradition did not bind them to the number used by Euclid, nor did they hold strictly enough to the logical point of view to want to reduce the number to a minimum. Only in recent years have we come to realize that this freedom in the use of assumptions is highly desirable from a pedagogical point of view. (44).

While the majority of works list axioms and postulates at the beginning of the book, others give them when needed. LAMY has in his work (45) about forty « suppositions » or « demandes », distributed according to the need. This also is becoming more and more the custom with writers of the present time. (46).

c. *Use of Geometry.*

Either in the preface or under a separate heading at the beginning of the book, these geometries nearly always bring out their estimate of the utility of the subject. The Latin edition of LE CLERC (47)

(42) Ed. of 1702, pp. 3-13. « Von Benennung der Dinge/ so in der Geometria fürkommen. »

(43) Ed. of 1620. Defs. precede the three books.

(44) « Reorganization of Mathematics », p. 25.

(45) Ed. of 1685.

(46) PALMER-TAYLOR-FARNUM : « Plane Geometry », 1924; also AVERY : « Plane Geometry », 1925.

(47) Ed. of 1692, p. 3. « De ejus utilitate. »

is a particular example of this. He refers to its applications in studies of astronomy, geography, architecture, machinery, optics and military tactics. This also is now agreed upon as a point of pedagogic value. (48).

d. *Use of Instruments.*

Seventeenth century geometers differ very widely from EUCLID in the use of instruments. The latter, as is well known, excluded mensuration and all practical material from his work and held strictly to the use of ruler and compass. The former made use of as many instruments that were valuable in mensuration as they as they could devise. BOURDIN (49) devotes two full pages of discussion and two more of figures to the explanation and illustration of the instruments of geometry. These were doubtless used and perhaps even constructed by the students. There is good pedagogy in the use of various devices whose operations involve the application of geometric principles.

e. *Introduction of Symbols.*

It has already been stated that it was not until near the close of the period of this study that the commoner symbols now in use met with general acceptance. This lack of a standardized symbolism made it necessary for each writer to give careful explanation of those signs and characters which he intended to use in his work. Hence there was greater need of some preliminary space being occupied with this explanation than there is today. The use of symbols became with some authors, as, for example, HERIGONE, almost a fad and, because of the excessive number used, complicated rather than aided the teaching process.

f. *Acquaintance with Geometric Forms.*

The student of seventeenth century geometry was made acquainted with geometric forms not so much through the introduction of preliminary construction work in connection with the use of instruments, as by the copious graphical illustration of the terms defined and the practical nature of the material throughout the texts. Such works as the « *Nova Geometria* » of LE CLERC serve

(48) The texts of AVERY and PALMER-TAYLOR-FARNUM have this preliminary material.

(49) 1661, pp. 14, 15.

almost exclusively the practical aim of making the student familiar with the geometric forms common in nature and life.

g. Historical Sketch.

An historical sketch is frequently included in the preliminary material just as is now done by the more modern texts. Thus « La Géométrie française » by BEAULIEU (1676) contains an « Avant-propos de l'auteur à toutes conditions sur le sujet de l'origine et commencement de la Géométrie, des premiers Hommes qui s'en sont servis, les premiers inventeurs d'icelle ». Similarly LEYBOURN (1690) and LE CLERC (1690) include short sketches of history.

h. Bibliography.

Very rarely one finds at the beginning a short bibliography of the writings used in the preparation of a book. An interesting one is found in the work on mechanical instruments by HULSIUS. The author lists eighty-three writers the products of whose pens have been useful to him. He begins with ARCHIMEDES (210 B.C.), not feeling very sure about earlier writers (50), and closes with his own contemporaries.

i. Relation between Geometry and Other Branches of Mathematics.

Occasionally some attempt is made to show how geometry is related to other branches of mathematics. Thus KECKERMANN gives at the beginning (51) a general table of the sciences showing how the subjects are related to each other. Attention has already been called in an earlier article (See the author's article in *Isis*, vol. X on The Distinctive Features of 17th Century Geometry, under Proportion and Similarity of Polygons.) to the lack of sharply drawn lines of separation between the branches of mathematics, and LEYBOURN, TACQUET, ARDÜSER and OUGHTRED were mentioned as authors whose works illustrate in one way or another some phase of correlation. BLONDEL's « Cours de Mathématique » (1699) gives fifty-six pages to a treatment of mathematics in general before

(50) Ed. of 1604, p. 6. « Wir wollen hie nicht weitlaufftig vermelden was IOSEPHUS TERTULLIANUS, ORIGINES und andere schreiben/ dass SETH der Sohn von ADAM, HENOCH, ABRAHAM, IOSEPH, MOYSES, etc. die Mathematic. Kunst gepflegt haben/ sondern wollen zu denen kommen /davon wir jehr sicherheit haben/ und deren Bücher gefunden werden. »

(51) 1621, p. 52.

considering speculative and practical geometry. These efforts on the part of textbook writers at giving the student a general survey of the field of mathematics before taking up geometry in particular obviously have in them that which savors of good pedagogy.

4. ORDER OF FORMAL GEOMETRY THEOREMS.

We naturally look for some regularity of the order of formal theorems in the geometries of the seventeenth century because of the fact that the texts of the present time show so much uniformity. An examination of ten geometries published during the last few years indicates the usual sequence to be about as follows : 1. Rectilinear figures. 2. Circle. 3. Proportion. Similarity of Polygons. 4. Arcas of Polygons. Trigonometry. 5. Regular Polygons. Measurement of the Circle. Other topics may be introduced here and there or the subject of areas may be interchanged with proportion and similarity, which are then followed quite naturally by trigonometry. But with the exception of these changes one modern geometry is, in general outline, very similar to any other. The chief difference between the above sequence of subject-matter and that of Euclid's Elements, so far as that which is common to both is concerned, is that Euclid considered regular figures immediately after the circle.

The editions of EUCLID's Elements and those works which adhere quite closely to the Elements do, as is expected, agree quite well in sequence. But we find a wide variation in the practical texts. A few examples will serve to illustrate.

The practical geometry of ERRARD (1620) is composed of three books. 1. Seven chapters on altimetry. 2. Eleven chapters on areas, including the mensuration of the spiral and oval. 3. Fourteen chapters on the measurement of solids, in which irregular solids, spheroids, and bodies with oval and spiral bases are considered.

VAN CEULEN's work (1615) takes this sequence : Part I, 68 pages, mostly arithmetic. Part 2. 46 pages on the fundamentals of geometry with examples. He refers to propositions of Euclid. Part 3. 53 pages on the changing of figures. Part 4. 34 pages of examples in geometry.

The contents of SCHWENTER's volume (1667) is as follows : « Im I. Aus rechtem Fundament gewiesen wird; wie man in der Geometria, auf dem Papyr und Lande/ mit denen darzu gehörigen

Instrumenten ja zur noht/ ohne dieselben/ verfahren und practiciren solle. »

« Im II. Wie ohne einig künstlich Geometrisch Instrument/ allein mit der Messruthe und etlichen Stäben/ das Land zu messen. »

« Im III. Die Beschreibung dess nützlichen Geometrischen Tischleins M. JOHANNIS PRAETORII. »

« Im IV. Die Erfindung CAMILLAE RAVERTAE, aus einem Stand das Land zu Messen. »

Besides omitting most of the rigorous formal geometry the works of the type illustrated above usually contain something on altimetry and conic sections. Great value was placed on the ability to measure inaccessible heights and distances. That conic sections and the spiral were so often included is due in part, at least, to the fact that geometers did not limit themselves to the use of ruler and compass.

5. TRIGONOMETRY.

The practice of introducing trigonometry into earlier courses of mathematics was pointed out in the previous article by the author in *Isis*, already referred to. It is only necessary here to call attention to the pedagogical value of the way in which the subject was introduced. It is highly significant that GAUTRUCHE (52), LE CLERC (53), TAYLOR (1707) and others give some numerical trigonometry along with the geometry, and that their method of introducing it is in no way disconnected or unnatural. With such suggestive examples it is difficult to account for the later arrangement of the branches of mathematics in the airtight compartments that prevailed until recently. Surely we must give seventeenth century writers credit for some of the present ideas of reform in secondary mathematical education.

6. USE OF PICTURES.

Well-drawn, clearly-lettered figures, placed in such relationship with the context that no unnecessary turning of leaves must be done by the student, are now considered absolutely essential in a good textbook. Books of this kind first appeared in the seventeenth

(52) 1668, p. 63.

(53) 1690, p. 166.

century. While the better geometries of the sixteenth century contain figures as good as the poorer works of the period of our study, the average quality of their figures is far inferior. Indeed it was not until 1556 that FINAEUS abandoned the method of putting figures in the margin.

In 1658 the great educator COMENIUS published his « *Orbis Sensualium Pictus* » which is the « first illustrated reading book on record ». (54). It is interesting to note that the one man to whom COMENIUS was perhaps most indebted for his methods of education was J.H. ALSTED, under whom he studied and who was one of the textbook writers of this period (55). The idea of COMENIUS on the use of pictures represents the first practical application of the intuitive method. It found its way into some of the geometries before the close of the century. Both BOURDIN (1661) and LE CLERC (1692) use the right page of the open book for figures and the left page for reading matter relating to them. In the work of LE CLERC the plain geometric figures are set in a framework of elaborate drawings, which sometimes also have some bearing upon the problem.

7. CATECHETICAL BOOKS.

There are a few works of this period which belong to the catechetical books. The geometries of RUDD (1650) and BEUTEL (1660) have been referred to. One other which appeared just before the close of the century should be mentioned. The « *Mathesis Juvenilis* » of STURM (1699) puts a number of the problems in the form of questions. Another important feature of this work is that directions for the use of the book are given to teachers, and the work is graded so as to be of highest value to the different Gymnasium classes.

MODES OF TEACHING EMPLOYED.

We turn now to a consideration of the actual manner in which the material of geometry was presented to the 'pupils. Basing our judgment only upon the material and the method of presenting

(54) GRAVES : « *Great Educators of Three Centuries* », 1912, p. 31.

(55) *Ib.*, p. 33.

it in the texts we are still able to obtain a fair conception of the forms of class exercises* then used or forecast. This is true because of the fact — already stated at the beginning of this article — that the textbooks are the works of teachers who labored in the same field of interest covered by the texts.

THE LECTURE MODE.

That the lecture mode was by far the most popular among seventeenth century teachers is well known. From the point of view of present teaching, this mode is entirely out of place. But it was much more satisfactory then on account of the ages of the pupils taking the subject.

It has been stated that geometry students of the period of our study were in the main adults. The Gymnasia of Germany, which were among the earliest of all secondary schools to include geometry in their curricula, did not teach that subject generally until well into the eighteenth century. There were a number of exceptions, as is shown by the following quotation : « Die erhaltenen Lektionspläne des Gymnasiums zeigen 1619 und 1624 je 1 Stunde Mathematik in I, dagegen 1643 in allen 3 Klassen combinirt eine Stunde Arithmetik und in I und II combinirt 1 Stunde ars sphaerica, ähnlich 1647. Die Geometrie ist also besonders nicht genannt, wird aber unter Mathematik mitverstanden sein, welcher Ausdruck 1643 wieder fehlt. Es darf das daraus geschlossen werden, dass die Lehrbücher, die Schröter für seinen Unterricht geschrieben hat, auch etwas von der Geometrie enthalten. » (56). A few other schools introduced mathematics during the century (57) but as a very general thing geometry was studied only by adults. When we remind ourselves that the lecture mode with occasional modifications is still very widely used at the present time in colleges and universities, with the supply of textbooks easily available to all students, it should not surprise us to find that the lecture mode prevailed in the seventeenth century when the pupils' difficulty in procuring texts almost necessitated its use.

An interesting work on this point is that of UNVERZAGT (1641)

(56) HELLMAN : « Ueber die Anfänge des mathematischen Unterrichts an den Erfurter evangelischen Schulen im 16. und 17. Jahrhundert und bis etwa 1774 ». Part II, p. 5.

(57) STAMPER, pp. 64, 65.

which contains a complete program of lectures given by the author in the University of Louvain. The « ordo disputationum » is arranged by months, beginning with October and running throughout the year. Each month a new subject is taken up. Beginning with « Geometricae », the topics continue in the following order : « Arithmeticae », « Opticae », « Staticae », « Hydrostaticae », « Navticae », « Architectonicae », « Polemicae », « De Machinis Bellicis », « Geographicae », « Astronomicae », and « Chronologicae ». The work on geometry is divided into three seven-day periods. The « argumentum » for each of these three periods is here given :

Hebdomas Prima. Argumentum.

Anni secularis mensem consecramus primum GEOMETRIÆ; quòd huius elementa (de eius dignitate nihil ut dicam ad ceteras disciplinas mathematicas, aditum aperiant : quae ne, ut solent principia, difficultate incipientes terreant, facilioribus demonstrationibus, e nouo ordine illustramus. Damus itaque 1. sese secantes lineas deinde parallelas 2. Trianguli singularis, tum ad aliud relati affectiones prosequimur. 3. Circuli centrum, sectiones, contactusque, quae tum à lineis rectis, tum à circulis fiunt, consideramus. 4. Proportionem, quae inter triangula, parallelogramma, aliasque figuras similes intercedit. 5. Linearum, laterumque, quae triangula faciunt, potestatem explicamus. 6. Superficies, quae parallela, quae perpendicularis, examinamus. 7. Statuimus, quae corpora sint aequalia, qua proportione ad se mutuò parallelepipeda, prismata, cylindri, conii, sphaerae, e his similia.

Hebdomas Secunda. Argumentum.

- - - Ordiam 1. ab anguli definitione, à cuius recta intelligentia cetera omnia dependent. 2. Diversitatem proponam, quam anguli, vel à lineis vel contactu, vel superficie sumunt. 3. Difficultatem, quae hisce inest, attingam. 4. Paradoxa, quae ex angulo misto multi deducunt, 5. Opiniones, quibus de anguli quantitate auctores inter se dissident. 6. Huius anguli naturam explicabo. 7. Litem componam, dicamque : angulum mixtum indeterminatum, indeterminato angulo rectilineo, et determinatum determinato exhiberi posse aequalem.

Hebdomas Tertia. Argumentum.

- - - Quare ita hanc suppellectilem partiemur, ut explicemus 1. Cuius sint generis, quae Geometriae usum praestent. 2. Quibus radius propositam figuram omni in proportione pingendo imitetur 3. Quibus proportionibus instruat regulas, ut lineas, superficies, corpora augeat, minuat, aut permutet. 4. Remota, et inaccessa, quomodo angulis suis attingat, et quadrato mensuret. 5. Circuli partes proponimus, quae ex tabularum

subsidio accuratiùs de angulorum mensura indicant. 6. Tantò certius indicium hoc ut euadat, plures in partes singulos gradus subdiuidimus. 7. Exponimus instrumenta, quibus corporum exploramus molem.

This book is adorned at the beginning of the treatment of each seven-day period with an illustration which usually shows two children doing something relative to the work under discussion, one of them acting as teacher and the other as pupil. Both are provided with instruments and the pupil seems to be trying out the information he is getting from the teacher. This suggests strongly that the lecture mode as used by UNVERZAGT was in no way as formal as our present understanding of that manner of teaching suggests.

THE LABORATORY MODE.

We have seen that seventeenth century geometry students made unlimited use of numerous measuring devices, whole books being left us on mechanical instruments (58); that some of the textbooks of geometry were well supplied with elaborate drawings; that the chief emphasis in the statement of the aims of geometry was placed upon utility; that the subject was studied in close connection with planimetry, stereometry and all kinds of field work; and that treatises on geometry were often bound up with works on surveying, geodesy, cosmography and other studies. Furthermore, as is seen in some of the proofs, the course of progress was nearly always from the particular to the general, from the concrete to the abstract. These facts indicate quite clearly that the essential features of the laboratory mode of teaching were present to a marked degree in seventeenth century geometry.

PRIVATE INSTRUCTION.

The individual mode of teaching was one of great importance in this period, and hence we find among the textbooks some which were written for the purpose of meeting the need of private instruction. Thus the title page of the « Cours de Mathématique » of BLONDEL (1699) indicates that the book was written for the use of the Dauphin whose private teacher BLONDEL was for some time. SIMON STEVIN also gave private instruction in his spare time.

(58) HULSIUS : « Tractat der Mechanischen Instrumenten », 1604.

There are two 1684 editions of the anonymous « Elements or Principles of Geometry », one of which, according to the title page, was « prepared for use by young RALPH FREMAN », while the other was « now with due respect publicly dedicated ».

That there was much individual instruction in geometry carried on as late as the close of the seventeenth century is indicated by the following advertisement which appeared in the Boston News-Letter of March 21, 1709 : « Opposite to the Mitre Tavern in Fifth-street next to Scarlet's Wharff, Boston, are Taught, Writing, Arithmetick in all its parts; And also Geometry, Trigonometry, Plain and Sphaerical Surveying, Dialling, Gauging, Navigation, Astronomy; The Projection of the Sphaere, and the use of Mathematical Instruments : By OWEN HARRIS. Who Teaches at as easie Rates, and as speedy as may be. » (59).

THE HEURISTIC MODE.

The few catechetical works left from this period do not indicate by the nature of their questions and answers that any use was made of what we now term the heuristic mode of teaching. But if the essential feature of that mode is regarded as that procedure in teaching which will lead the pupil to discover things for himself, regardless of whether this is accomplished by questioning or otherwise, then it is clear that there is a true connection between this and the laboratory mode. Both were to some extent anticipated in this century.

OTHER MODES.

Other modes now in use, including the well-known recitation method of teaching, are not indicated in the textbooks of seventeenth century geometry now extant.



SUMMARY.

The findings of the present investigation may now be summarized. It will be seen that numerous good pedagogical principles were used by the writers of the geometries of this period.

(59) Quoted also in SIMONS : « Introduction of Algebra into American Schools in the 18th Century », Washington, 1924.

1. While it is true that the textbooks left us from the seventeenth century furnish our sole source of information, this is not such a great handicap because

- a. about two hundred of them are still extant, and
- b. a large majority of the authors of these textbooks were leading teachers of that day.

2. We can clearly distinguish three classes of aims in the instruction of geometry in this period, as follows :

- a. Utilitarian aims received the most emphasis.
- b. A considerable number of teachers believed in the transfer of disciplinary training from geometry to other activities of life.
- c. The study of geometry was considered valuable from a cultural and spiritual point of view.

3. The synthetic method of presentation prevailed in the texts because of its brevity and value in stating formally the proofs obtained.

4. The analytic method was well known and widely used, and is especially well treated in the last book of the work of LAMY.

5. In some works terms are defined and introduced only when and as needed.

6. Entire freedom is used in some of the books in the use of assumptions. There is no effort made at cutting the number of axioms and postulates down to the minimum.

7. The use of geometry is usually given a short treatment at the beginning of the book.

8. Students were made thoroughly acquainted with the value of instruments in geometry.

9. The texts are written so as to acquaint the reader with the many geometric forms common in nature and life.

10. A sketch of the history of the subject is often given.

11. A short bibliography is sometimes found at the beginning of the text.

12. Introductory chapters are given here and there to show the relation between geometry and other branches of mathematics.

13. The lack of a standard symbolism was a handicap in teaching during this period.

14. The sequence of theorems in the works not adhering to EUCLID's Elements is quite unsettled, but some writers, in making

choice of sequence, gave careful attention to the establishment and use of better principles of teaching.

15. Numerical trigonometry was introduced in connection with the geometry.

16. Proper drawing and placing of figures added to the teachableness of some of the texts.

17. A few of the works have their material presented in the form of questions and answers.

18. The lecture mode was the most popular among seventeenth century teachers. On account of the mature ages of pupils and the scarcity of textbooks it was more justifiable then than it is at the present time.

19. The essential features of the laboratory mode are brought out in these works to a marked degree.

20. Private instruction was extensively carried on and some of the texts were written with that end in view.

21. Heuristic teaching is suggested only in connection with its relation to the laboratory mode.

22. The recitation mode, as well as other modes now considered in the pedagogy of mathematics, does not appear in the works of this study.

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F. W. KOKOMOOR.

Le premier conflit entre la théorie ondulatoire et la théorie corpusculaire de la lumière.

Quoi de plus passionnant, dans l'histoire de la Science, que cette lutte où s'affrontent, dès leur naissance, les deux conceptions, continue et discontinue, de la nature de la lumière ? La théorie corpusculaire triomphe d'abord, assez obscurément d'ailleurs, au XVIII^e siècle ; sa rivale prend au siècle suivant une revanche éclatante. A l'heure actuelle, le conflit est entré dans une phase aiguë, qui en fait la question centrale de toute la physique moderne : peut-être est-ce à la fin de la lutte que nous assistons, peut-être la nouvelle Mécanique ondulatoire apportera-t-elle la paix en établissant une grandiose synthèse des deux points de vue antagonistes. Quel contraste entre la formidable crise actuelle et la première escarmouche où les inventeurs des deux théories s'efforçaient de mettre en relief leurs avantages respectifs ! Mais pour être plus modeste, ce premier conflit n'en est pas moins intéressant, surtout par la personnalité des deux adversaires, et il vaut la peine qu'on s'y arrête un peu, pour étudier successivement les deux thèses en présence, leurs arguments respectifs, et les causes de la victoire des idées corpusculaires.

I. — *La théorie des ondulations.*

Le créateur de la théorie des ondes est sans contredit HUYGENS ; car, comme le remarque très justement WHITEHEAD, (1) « it is the establishment of the procedure of taking the consequences seriously which marks the real discovery of a theory. » Les précurseurs (2) de HUYGENS sont en effet absolument insignifiants ; il

(1) WHITEHEAD, *The Concept of Nature*, Cambridge, 1920, p. 26.

(2) PARDIES, *Statique*, Paris, 1674, Préface.

ANGO, *L'Optique divisée en 3 livres*, Paris, 1682.

HOKE, *Micrographia*, London, 1665.

ne se fait d'ailleurs pas faute de l'écrire lui-même, dans une lettre à LEIBNIZ, (3) à propos d'un certain KNORRE, qui avait soutenu une thèse sur la théorie ondulatoire : « Je suis bien aise de voir ma Theorie approuvée quoyqu'il me fasse un peu tort de dire que mon explication de la refraction est dans le fond la mesme que celle de HOOKE et de PARDIES, et n'en differe qu'en la manière d'expliquer. Car tout consiste dans cette maniere, et ces autheurs auroient esté bien empeschez à rendre raison des bizarreries du cristal d'Islande, outre que HOOKE a fait des bevues honteuses que j'aurois bien pu relever si j'eusse voulu. » Il est encore plus mordant à l'égard du P. ANGO : « il dit avoir pris une partie des écrits laissés par le P. PARDIES, mais il aurait micux fait d'éditer tel quel le manuscrit du P. PARDIES. » (« welcke seght uyt de overblijfsels van P. PARDIES een gedeelte genomen te hebben, doch soude beter gedaen hebben van het schrift van P. PARDIES uyt te geven soo het lagh. ») (4)

Il importe d'abord d'examiner dans quel esprit HUYGENS présentait sa théorie, ou plus généralement quelle idée il se faisait du rôle et de la signification des théories scientifiques. L'illustre Hollandais a subi fortement l'influence de DESCARTES : il a eu comme maître VAN SCHOOTEN, un des plus brillants disciples du philosophe français. Sans doute un esprit de cette trempe ne pouvait tarder à reconnaître les faiblesses de la doctrine cartésienne et à s'en affranchir : « ... dico ipsum [CARTESIUM] errasse in [multis rebus]... Equidem neque hanc [Cartesianam philosophiam] neque Aristotelicam neque ab uno quopiam autore denominatam invehi vellem, sed unius veri ratione haberi, ita ut a singulis ea sumantur quae optima ac rationi convenientissima censebuntur. Nihil autem magis obesse videtur philosophicis studiis quam si in formam systematis redigantur, unde rerum omnium causae quasi jam compertae depromantur. Vix enim ulla satis adhuc tenemus, neque proficere inquirendo possumus si, quod nescimus, scire nos arbitremur. » (5) Néanmoins, malgré cet électisme et cette remarquable liberté d'esprit, il a toujours suivi fidèlement, et même avec un aveuglement, DESCARTES sur un point essentiel

(3) *Œuvres de C. HUYGENS*, publiées par la Société hollandaise des sciences t. X, 1609 (29 mai 1694). (Ce recueil sera désigné par O. H.)

(4) O. H., t. X, p. 204 (22 novembre 1691).

(5) O. H., t. X, p. 104 (lettre à MEIER, juin 1691).

de sa doctrine, le *mécanicisme* : « Multum CARTESIO debemus quod novas vias in physicae studio aperuit atque omnia ad mechanicas rationes reducenda author fuerit. » (6) Dans le *Traité de la lumière*, il parle de « la vraie philosophie, dans laquelle on conçoit la cause de tous les effets naturels par des raisons de mécanique. Ce qu'il faut faire à mon avis, ou bien renoncer à toute espérance de ne jamais rien comprendre dans la physique. » C'est ce dogme mécaniciste qui le conduit à rejeter le principe de la Gravitation universelle, tout en admettant la loi d'attraction pour les planètes. (7) Aussi ne nous étonnerons-nous pas de le voir se donner beaucoup de mal pour imaginer un modèle mécanique rendant compte de la propagation des ondes lumineuses.

Quant à sa conception des théories scientifiques, on peut en juger surtout par la préface du *Traité de la lumière*. Il y développe l'idée qu'une bonne hypothèse est celle dont les conséquences, et surtout les prévisions de phénomènes encore inconnus, se vérifient par l'expérience; mais il ne dit rien sur la méthode qui doit guider dans l'élaboration des hypothèses. Il est un peu plus explicite dans une lettre à TSCHIRNHAUS : (8) « In quibus [physicis] ego tamen summam difficultatem restare existimo, nec aliter eam superari posse quam ab experimentis incipiendo... deinde hypotheses quasdam comminiscendo ad quas experimenta expendantur... Sed ita quoque permagnus labor superest, nec solum sagacitate insigni opus, sed saepe et felicitate aliqua. » Nous sommes loin, on le voit, de la méthode d'induction si énergiquement affirmée et si génialement appliquée par NEWTON à la découverte de la dispersion de la lumière et de la gravitation universelle. D'ailleurs, dans l'une et l'autre de ces questions, HUYGENS a pris position contre NEWTON en termes qui laissent clairement voir qu'il n'a pas compris le point de vue de celui-ci. (9)

Ce que nous venons de dire de l'attitude scientifique d'HUYGENS nous permet de comprendre le mode d'exposition de sa théorie, si différent des *Questions* qui terminent l'*Optique* de NEWTON.

(6) O. H., t. X, p. 195 (lettre à MEIER, 16 novembre 1691)

(7) *Dissertatio de Causa gravitatis*, Additamentum, in *Opera reliqua*, Amsterdam, 1728, vol. 1, p. 121.

(8) O. H., t. IX, p. 124 (10 mars 1687).

(9) Cf. mon article sur *la théorie des Couleurs de Newton et ses adversaires*, *Isis*, 9. 44-65, 1927.

Il débute (10) par une discussion d'allure cartésienne établissant que la lumière résulte « du mouvement de certaine matière. » Il rejette rapidement, comme nous le verrons plus loin, l'idée d'une émission de corpuscules par le corps lumineux, et il introduit l'hypothèse d'une propagation ondulatoire, en se guidant sur l'analogie des ondes sonores. Ceci impliquant une vitesse finie de propagation, il s'arrête d'abord à discuter cette question. Puis il estime que la propagation de la lumière ne peut se faire par ondes de compression et d'expansion comme celle du son, à cause de sa grande vitesse. Ceci l'amène à un modèle d'ondes élastiques *longitudinales* : il imagine que l'éther est constitué par de petites particules très dures et très élastiques serrées les unes à côté des autres. Les résultats qu'il a obtenus sur le choc des corps élastiques lui permettent d'expliquer la propagation d'une et même de plusieurs ondes dans un tel milieu ; il rendait déjà compte ainsi d'un fait banal d'expérience, l'indépendance des faisceaux lumineux ; ce fait lui paraissait incompatible avec une théorie de l'émission. Mais le point capital et vraiment important de sa théorie est l'énoncé du principe bien connu qui porte aujourd'hui son nom, et qui lui permet d'expliquer la propagation rectiligne de la lumière. A vrai dire, il présente son principe d'une manière plutôt confuse, et il ne cherche pas à le justifier autrement qu'en invoquant la vérité de ses conséquences ; néanmoins, il est certain qu'il en avait pleinement reconnu la signification et la portée : cela se voit déjà à l'usage habile qu'il en fait dans son *Traité*, et cela se verra mieux encore dans la discussion avec NEWTON. Tels sont les principes de la théorie d'HUYGENS ; dans les chapitres suivants, il en déduit les lois de la réflexion, de la réfraction et la théorie de la réfraction atmosphérique ; enfin l'introduction d'ondes sphéroïdales à côté des ondes sphériques lui donne la théorie complète de la double réfraction du spath d'Islande. En revanche, il doit avouer son impuissance à expliquer les phénomènes de polarisation qu'il a lui-même découverts.

L'élégance du traitement géométrique de la théorie fait du *Traité de la lumière* un véritable bijou mathématique. Aussi fut-il accueilli partout avec admiration. « On ne peut rien voir de plus

(10) J'utilise la réimpression de la Collection SOLOVINE, Paris, GAUTHIER-VILLARS, 1920 (*Isis*, 4, 148) *Le Traité de la Lumière* a été écrit en 1678, mais publié, à Leyde, en 1690 seulement.

beau que le premier de ces Traités [celui *de la lumière*; l'autre est celui *sur la cause de la pesanteur*] » écrit FATIO DE DUILLER (11). Quand j'ai vû que la supposition des ondes sphéroïdales, dit LEIBNIZ (12), vous sert avec la même facilité à resoudre les phenomenes de la refraction disdiacastique du cristal d'Islande, j'ay passé de l'estime à l'admiration » DENYS PAPIN (13) » approuve » le principe de l'onde enveloppe, et admire lui aussi l'ingéniosité de l'hypothèse des ondes sphéroïdales; il soulève d'ailleurs quelques difficultés « cartésiennes » sur la constitution de l'éther. Enfin NEWTON, par l'intermédiaire de FATIO DE DUILLER, (14) reconnaît, tout en rejetant ses conclusions, la beauté du travail d'HUYGENS : « Mais quoique cette Theorie soit parfaitement belle et digne de son Auteur, il y a des raisons tres fortes, tirees des proprietés de la Lumière et des Couleurs, qui nous persuadent que les raions de Lumière sont des corpuscules qui viennent actuellement du Soleil et des Etoiles jusques à nous. » La théorie d'HUYGENS trouva même tout de suite un écho dans les Universités : KNORRE en fait l'objet d'une thèse à Wittenberg (15), et DE LA HIRE (16) en parle dans ses leçons du Collège de France. Mais cette faveur devait être éphémère.

II. — *La théorie corpusculaire.*

Avec sa défiance bien connue à l'égard des hypothèses, NEWTON n'a jamais défendu systématiquement une théorie corpusculaire; il s'est borné à montrer que les phénomènes connus pouvaient s'expliquer par une théorie de ce genre, tandis qu'une théorie *purement* ondulatoire se heurte à des difficultés qu'il juge avec raison insurmontables. Il ne faut pas s'attendre à trouver, dans les images théoriques qu'il propose prudemment sous forme de questions, la cohérence et l'harmonie de l'exposé d'HUYGENS : le physicien hollandais se laisse guider sur une route rigide par des raisonnements *a priori*; le maître de la méthode inductive

(11) O. H., t. IX, p. 381 (24 février 1690).

(12) O. H., t. IX, p. 521 (octobre 1690).

(13) O. H., t. IX, p. 559 (6 décembre 1690).

(14) O. H., t. X, p. 605 (9 avril 1694; lettre à DE BEYRIE, communiquée à LEIBNIZ).

(15) KNORRE, *Dissertatio dioptrica de refractione luminis*, Wittenbergae, 1693. Cf. O. H., t. X, p. 600; p. 611.

(16) O. H., t. X, p. 5 (17 janvier 1691).

part de divers groupes de faits d'expériences et ne s'en éloigne jamais beaucoup; dans chaque cas, il examine soigneusement les différentes explications possibles; il les combine autant que possible de manière à aboutir à un ensemble satisfaisant : de là une théorie un peu disparate, un peu compliquée, mais aussi plus nuancée et plus souple.

C'est ainsi que dans sa théorie de la lumière, le concept d'onde joue un rôle extrêmement important; c'est un des caractères les plus remarquables de cette doctrine, et je pense qu'on ne lui a pas accordé toute l'attention qu'il mérite. La magistrale analyse du phénomène des anneaux colorés l'amène à reconnaître le caractère de *périodicité* de la lumière, au moins à l'intérieur des milieux réfringents; c'est ce qu'exprime la Proposition XII du Livre II, 3^e Partie, de l'*Optique* : (17) « Tout Rayon de Lumière acquiert, en passant à travers une Surface réfringente quelconque, une certaine constitution ou disposition transitoire qui dans le progrès du Rayon revient à intervalles égaux, & fait que le Rayon, à chaque retour de cette disposition, est transmis aisément à travers la Surface réfringente qui vient immédiatement après, & qu'à chaque intermission de cet état, il est aisément réfléchi par cette même Surface. » Après avoir montré comment cette loi se déduit de ses observations, il ajoute : « De savoir ce que c'est que cette action ou disposition ;... c'est ce que je n'examine point ici. Ceux qui n'aiment point à admettre aucune nouvelle découverte, à moins qu'ils ne puissent l'expliquer par une hypothèse, peuvent supposer pour le présent, que comme les Pierres jettées dans l'eau, y excitent des ondulations,... » les rayons tombant sur le milieu réfringent y produisent des vibrations qui se propagent à la manière des ondes sonores; « qu'elles ont un mouvement plus rapide que celui des Rayons, de sorte qu'elles les atteignent ; ...& qu'ainsi chaque Rayon est successivement disposé à être aisément réfléchi, ou aisément transmis par chaque vibration qui l'atteint. Mais je n'examine point en cet endroit, si cette hypothèse est vraie ou fausse. »

Ainsi NEWTON avait clairement reconnu que la périodicité manifestée par les phénomènes d'interférence impliquait l'intervention d'un mécanisme « de circulation ou de vibration dans le Rayon, ou dans le Milieu. » (17) Convaincu par l'examen d'autres faits

(17) Traduction française de COSTES, 2^e éd., Paris, 1722. pp. 327 sqq.

que l'ondulation ne peut être une qualité du *rayon*, il imagine une hypothèse ingénieuse expliquant comment le milieu peut communiquer au mouvement du corpuscule la périodicité voulue. D'après cette hypothèse, c'est d'ailleurs le corpuscule lui-même qui détermine, en même temps que le milieu, la longueur des ondes acolytes. Si donc on pouvait se passer du corpuscule, et adopter un modèle purement ondulatoire, on devrait imaginer chaque rayon comme une onde de longueur bien déterminée pour un même milieu, mais variant quand on passe d'un milieu dans un autre; on serait alors immédiatement conduit à établir, pour un milieu déterminé, une relation entre la *longueur d'onde* et la *couleur*. Nous avons la preuve que NEWTON a poussé jusque là ses réflexions sur la théorie ondulatoire; (18) il était sur ce point infiniment plus loin qu'HUYGENS lui-même, qui avait bien vu le problème, mais qui n'avait pu le résoudre : « Les Experiences qu'a fait Mr. NEWTON de la différente refraction des rayons colorez sont belles et curieuses, mais il n'explique pas ce que c'est que la couleur dans ces rayons, et c'est en quoy je ne me suis pas pleinement satisfait non plus jusqu'à present. » (19)

En présence de ces faits, il me semble légitime de conclure que si NEWTON a préféré une théorie compliquée de l'émission, impliquant une dissymétrie des corpuscules lumineux (pour expliquer la polarisation) et la production d'ondes acolytes dans les milieux réfringents, c'est qu'il voyait dans la théorie des ondes des difficultés insurmontables; et il est absolument improbable qu'il se soit laissé aveugler par des idées préconçues, comme se le demande FRESNEL, (20) à propos de ses mauvaises observations sur la diffraction; nous aurons l'occasion de revenir sur ce point un peu plus loin.

III. — *La controverse entre HUYGENS et NEWTON.*

Dans la controverse qui va nous occuper maintenant, c'est NEWTON qui dirige le débat. Que pouvaient, en effet, lui opposer ses adversaires ? « Quand on considère, écrit HUYGENS, (21)

(18) Cf. mon article cité ci-dessus (9), pp. 61-62.

(19) O. H., t. X, p. 609 (29 mai 1694; lettre à LEIBNIZ).

(20) *De la lumière*, 1822; réimpression « Les Classiques de la Science », Paris, A. COLIN, 1914, p. 5.

(21) *Traité de la lumière*, p. 4.

l'extrême vitesse dont la lumière s'étend de toutes parts et que, quand il en vient de différents endroits, même de tout opposés, elles se traversent l'une l'autre sans s'empêcher; on comprend bien que, quand nous voyons un objet lumineux, ce ne saurait être par le transport d'une matière, qui depuis cet objet s'en vient jusqu'à nous ainsi qu'une balle ou une flèche traverse l'air : car assurément cela répugne trop à ces deux qualités de la lumière et surtout à la dernière. » Ces considérations pouvaient avoir un certain poids pour les physiciens du Continent, encore plus ou moins soumis à l'influence de DESCARTES; pour NEWTON, elles n'en avaient aucun, et il ne se soucia jamais de s'expliquer là-dessus, et de coordonner ses idées en un système minutieusement et rigidement déterminé, comme l'avait tenté HUYGENS; à son avis, tant que toute indication de l'expérience ferait défaut dans ce domaine, le physicien n'avait pas à s'y aventurer : « Hypotheses non fingo. »

En revanche, les objections de NEWTON à la théorie des onduations étaient parfaitement précises et pertinentes. Dès 1672, (22) il fait observer que la théorie des ondes est incompatible avec la propagation rectiligne de la lumière ; il développe cette objection dans les *Principia* et dans l'*Optique*. Lorsque les expériences d'HUYGENS sur la polarisation de la lumière lui furent connues, il y vit aussitôt une nouvelle difficulté pour la conception ondulatoire, tandis qu'il imaginait aisément le principe de leur explication en attribuant des « côtés » ou des « pôles » aux corpuscules lumineux. Jusqu'au moment où FRESNEL, encouragé par ses succès dans la théorie de la diffraction, eut la géniale hardiesse d'introduire l'hypothèse des vibrations *transversales* de l'éther, les phénomènes de polarisation devaient forcément rester une objection fatale à la théorie des ondes.

La première objection, au contraire, était beaucoup plus discutable, et c'est elle qui fut discutée victorieusement par HUYGENS. C'est dans les *Principia* que NEWTON l'expose pour la première fois en détail; il démontre (Livre II, Proposition XLII) que « Motus omnis per fluidum propagatus divergit a recto tramite in spatia immota », et le Scholie qui suit la Proposition L indique qu'il avait en vue dans cette étude « motum Lucis et Sonorum » :

« Lux enim cum propagetur secundum lineas rectas, in actione sola... consistere nequit ». Mais par son principe de l'onde enveloppe, HUYGENS avait rencontré cette objection; c'est ce qu'il fait remarquer dans le Supplément au *Traité sur la cause de la pesanteur*, (23) supplément consacré surtout à l'examen de l'ouvrage de NEWTON : il ne nie pas, dit-il, l'existence des ondes diffractées, mais il pense que leur intensité est trop faible pour qu'elles soient sensibles. NEWTON donne à son tour son avis, par l'intermédiaire de FATIO DE DUILLER, (24) sur les deux *Traités* d'HUYGENS; au sujet du passage qui nous intéresse, DUILLER écrit : « Mr. NEWTON se rend à ce raisonnement de Mr. HUGENS. » Ceci se passait en 1694, peu de temps avant la mort du physicien hollandais. Plus tard cependant, NEWTON retourne à son opinion précédente, car non seulement il ne modifie pas le Scholie en question dans les éditions suivantes des *Principia*, mais il reprend le même raisonnement dans la Question XXVIII de son *Optique*. Peut-être sont-ce les phénomènes de diffraction qui l'ont fait douter après coup de la valeur du principe d'HUYGENS; en tout cas il croit que ces phénomènes contredisent la théorie des ondes : « A la vérité, les Rayons qui passent fort près des extrémités de quelque corps que ce soit, sont un peu pliés par l'action de ce Corps... mais cette Inflexion ne se fait pas vers l'Ombre, elle ne se fait que du côté qui est opposé à l'Ombre... » Ceci, remarque FRESNEL, (25) est une grossière erreur, d'autant plus inconcevable que GRIMALDI avait déjà observé correctement le phénomène. On ne peut toutefois, comme je l'ai dit, soupçonner NEWTON d'idées théoriques préconçues; en fait, les hésitations et les erreurs du grand physicien dans le domaine de la diffraction sont faciles à comprendre : c'est un terrain dont il a dû laisser l'exploration inachevée, après une reconnaissance fragmentaire; on sent de suite qu'il n'y est pas maître.

Une troisième objection à la théorie des ondes, bien faite pour étonner le lecteur moderne, est soulevée par NEWTON dans la même Question XXVIII de l'*Optique*: « Il n'est pas moins difficile d'expliquer par le moyen de ces Hypotheses, comment les Rayons peuvent être alternativement dans les accès de facile Reflexion,

(23) *loc. cit.* (7), p. 125.

(24) *loc. cit.* (14).

(25) *loc. cit.* (20).

& de facile Transmission, si ce n'est peut-être qu'on veuille imaginer que dans tout l'Espace il y a deux Milieux étherés qui ont leurs vibrations particulieres; que les vibrations de l'un de ces Milieux constituent la Lumiere; & que les vibrations de l'autre, étant plus rapides, toutes les fois qu'elles atteignent les vibrations du premier, les mettent dans ces accès. Mais le moyen de concevoir que deux *Ethers*... puissent être répandus dans tout l'Espace, sans... brouiller leurs mouvements réciproques ? » On le voit : NEWTON se laisse fourvoyer par une « traduction » trop littérale de sa théorie des ondes acolytes, et le concept d'interférence ne lui est pas assez familier pour lui permettre d'apercevoir la vraie solution.

En résumé, contre la théorie des ondes se dresse une difficulté insurmontable : l'explication de la polarisation. La position de la théorie corpusculaire est donc à ce moment réellement très forte. Cependant nous voyons déjà apparaître les défauts de sa cuirasse : interférence et diffraction, tels sont les deux points faibles de NEWTON; c'est précisément sur ce terrain qu'un siècle plus tard la nouvelle théorie ondulatoire remporte ses premières victoires. Mais pourquoi fallut-il attendre un siècle les travaux de YOUNG et de FRESNEL ? c'est ce qu'il nous reste à examiner.

IV. — *Les causes de l'abandon de la théorie ondulatoire pendant le XVIII^e siècle.*

Indépendamment des arguments qui la défendaient, et dont nous avons apprécié la valeur, on peut dire que la théorie corpusculaire fut surtout protégée, en quelque sorte, par l'autorité formidable dont NEWTON jouit durant tout le XVIII^e siècle. Directement ou indirectement, c'est à sa personnalité presque légendaire — « Nec fas est propius Mortali attingere Divos » — qu'il faut remonter pour comprendre l'attitude des physiciens de cette époque.

Tout d'abord, on s'accoutume dangereusement à considérer tous les ouvrages de NEWTON comme des modèles d'une perfection achevée, qui ne laissent absolument plus rien à désirer. Sans s'apercevoir que cette attitude est directement opposée aux recommandations du grand maître, on se fait presque scrupule de toucher aux sujets dont il s'est occupé : ce serait de la présomption, et en

tout cas du temps perdu ! Dans le domaine de l'Optique, c'est à peine si on ajoute aux résultats de NEWTON la découverte de la spécificité du pouvoir dispersif ; malgré l'invitation expresse qui se trouve à la fin de l'*Optique*, on n'étudie pas les phénomènes de diffraction.

On interprète d'ailleurs d'une manière outrancière le fameux « Hypotheses non fingo ». (26) On en arrive à se désintéresser complètement des discussions théoriques ; l'importance de nouvelles connaissances sur les points imparfaitement fixés d'une théorie n'est pas comprise. On cherche des lois, on analyse des phénomènes, on ne cherche pas de synthèse — ou plutôt on se contente d'idées synthétiques vagues et générales. Et comment ne pas s'expliquer cette fièvre de découvertes : NEWTON est là qui leur montre le « grand Océan de la vérité, qui s'étend inexploré » devant eux ; lui-même a pu en extraire les joyaux les plus précieux ; mais que de trésors y gisent encore, enfouis depuis trop de siècles ! Et tumultueusement, comme pour rattraper le temps perdu, on expérimente, n'importe comment, sur n'importe quoi ; et c'est un émerveillement de tous les instants ! Pourquoi s'attarder à dresser des programmes de recherche, à imaginer des expériences cruciales ? on n'a qu'à puiser au tas...

Et voici que s'ouvre aux nouveaux « conquistadores » un immense domaine, qui unit à l'attrait de la nouveauté celui du mystère : bientôt les phénomènes électriques concentrent sur eux tout l'intérêt. Dans ces conditions, quel écho pouvaient bien trouver les réflexions d'un mathématicien (27) quelque peu dépaycé dans le domaine de la physique ? Au surplus, EULER traite la question « à la VOLTAIRE », et l'oubli où tombèrent ses critiques était certes mérité.

Enfin, les esprits synthétiques trouvaient à se satisfaire dans l'héritage grandiose légué par NEWTON. BOSCOVICH déjà, mais surtout LAPLACE crurent voir dans le concept des forces centrales le principe d'une synthèse générale des lois de la Nature ; la théorie de la gravitation, la loi des forces électriques, celles de la capillarité,

(26) Cf. P. BRUNET, *Les physiciens hollandais et la méthode expérimentale en France au XVIII^e siècle*, Paris, 1926.

(27) EULER, *Lettres à une princesse d'Allemagne*, Pétersbourg, 1786 ; lettres XVII et suivantes (vol. I).

la théorie corpusculaire de la lumière se groupaient autour de cette idée générale d'une manière qui pouvait paraître extrêmement satisfaisante : c'est surtout le développement de cette doctrine que LAPLACE a en vue dans sa magistrale *Exposition du Système du Monde*. La théorie du discontinu y atteint son apogée, — apogée que devait suivre de bien près la ruine.

(Liège).

L. ROSENFELD.

The Ch'ou-Jen Chuan of Yüan Yüan *

The interesting article by Père LOUIS VAN HÉE which appeared upwards of a year ago in *Isis* (8, 103-18) contains many statements to which no Sinologue could object, and for which all will be indebted to this learned Jesuit scholar. There are, however, certain other statements to which exception must be taken as giving a wrong impression of certain phases of the development of Chinese mathematics, and it is the purpose of this article to call attention to these features.

In the first place the title of the work is translated as « Biographies of Mathematicians », whereas the text relates almost exclusively to astronomers in general and particularly to those concerned with the regulation of the calendar, the lives of mathematicians being relegated to an appendix. This fact, indeed, is set forth by the author himself in his preface.

The expression *Ch'ou-jen* seems originally to have meant land surveyors. The ideograph for *ch'ou* consists of two parts, — *t'ien* and *shou*, — the former referring to cultivated land and the latter to man's age, counting of age, and sometimes merely to counting, as apparently in this case. With this meaning of « land-counting » or « land-surveying », *ch'ou jen* came to mean « land-surveying-men » or « land surveyors », and then « surveyors », and finally surveyors of the heavens, — astronomers. If this interpretation is correct, the ideograph *ch'ou* may be considered as akin to the Greek word from which comes the English geometry (earth measure). The interpretation which YÜAN YÜAN himself gives and which also appears in an appendix by TAN TAI are evidently quite untenable.

It should also be observed that YÜAN YÜAN passed the examination mentioned at the age of twenty-five instead of thirty-five.

(*) The writer wishes to acknowledge his indebtedness to*Professor DAVID EUGENE SMITH for assistance in revising this article for publication.

Furthermore his criticism on SUN-TZE is erroneously translated on page 106; he does not say that « many unnecessary details appear in his work, » his meaning being that his works are liable to have interpolations.

As to CHIA HÈNG (page 106), *Yeh-shih-yüang Tsang-shu-mu* is erroneously rendered by giving the meaning of the last four characters, the first two being disregarded. The six ideographs indicate a list of books owned by the Yeh-shih-yüan.

The expression *Chu-suan kê-chüeh* should not be translated « a rhymed verse on the abacus ». It means division verses to be applied to the abacus.

On page 107 eight scholars are listed as belonging to the Ch'in Dynasty (205-317), but YÜAN's work gives a ninth person. The name of the person mentioned is not T'su TSU SUNG, but YÜ SUNG. T'su Tsu is a common noun indicating relationship.

T'su CH'UNG-CHIH's value of π , $\frac{355}{113}$, is given in the Sui-Shi. If there was any interpolation, it must have been made before 1600, for the work was then very widely distributed. Moreover, there is an early copy of the work in the Seikado Library, Tokyo, printed from blocks in the Mongol dynasty and revised about 1530. In this there appears the passage in question, this part of the work undoubtedly belonging to the period of YÜAN. The matter is, therefore, entirely clear.

The ancient description of Tsu's south-pointing vehicle is very incomplete, and so it was impossible for YÜAN to have access to any detailed account of it. We are quite certain, however, from the researches of Messrs. HASHIMOTO and MOULE, that it was a mere mechanical device, without any connection with the mariners compass.

Tsu's work on the circle and his son's cubature of the sphere represent the highest development of native Chinese geometry, and they seem to have been the culmination of the general progress in this science through a period of about five centuries. If Tsu's circle measurement is to be looked upon as a later interpolation in the manuscripts, then all these accounts must be equally unreliable. Unless this sweeping denial is admitted, PÈRE VAN HÉE's arguments in connection with this development must be looked upon as lacking in rigor.

Father VAN HÉE's remarks on the Supplement of CHU KÊ-PAO

also seem open to serious question. The numbers assigned to names (page 116) do not agree with Chu's text. The names given are those that are considered in the first book, covering an age already discussed by YÜAN and I.O. More important and able scholars belonging to the same period had already been discussed in earlier works, but there are certain mathematicians of note, living after the ages considered by his predecessors, who are mentioned in CHU's later books.

While the Chinese feeling of superiority is obvious in the works above mentioned, this is only a natural result of the old-time culture. It appears in their name for the country, Chung-Hua, usually translated as Middle Kingdom, but more properly as Central Culture. It also is seen in the historic fact that the effect of the introduction of Western mathematics and astronomy in the sixteenth century, while at first very notable, was lost to a considerable degree a hundred years later. Not only did it meet with no encouragement from the traditionalists, but it was received under strong protest. Its effect was the encouragement of the study of the ancient classics rather than that of the introduction of new ideas from European sources. It was in this period of reaction, or of protest against Western science, that YÜAN wrote. He was not a specialist either in the domain of astronomy or in that of mathematics; but he was a philosopher and a man of general culture, and as such he was familiar with the traditional, classical, native mathematics of his own country. He may therefore be taken as a worthy representative of Chinese culture in the rather stagnant period between the introduction of Western learning by the early Jesuit fathers and its renaissance in the middle of the nineteenth century.

These circumstances explain how it was that YÜAN and his contemporaries were influenced to believe that the Occidental algebra developed from early Chinese sources. It was possibly with the desire to obtain the good will of the people that this belief was encouraged to a considerable extent by certain European scholars who were at the court of the emperor K'ANG-HSI, who told YÜAN that the word 'algebra' meant « a method originating in the East », — a fact established by MEI WEN-TING's grandson.

Father VAN HÉE expresses doubt as to whether the algebraic symbols and notation of China were influenced 'by Hindu or

Arab practice. This, however, is a matter of no moment, since the algebraic operations were carried out by means of calculating rods, the red indicating positive coefficients and the black representing negative ones. This particular type of mechanical calculation by the aid of rods was an essential feature of Chinese algebra. It is not found in other countries except where, as in Korea and Japan, it was derived from Chinese sources.

The learned Jesuit father is unquestionably correct in his view that the scholars of China did little for mathematics during the long period of their history, even though further research may reveal abilities not at present apparent. The evidence of a certain amount of geometric knowledge as contained in the *Nine Sections*, for example, was not adequately recognised even by the mathematicians who, in the thirteenth and fourteenth centuries, did so much for algebra. Even after EUCLID became known through the efforts of Father RICCI, Chinese mathematicians failed to grasp its significance. For this reason Father VAN HÉE has some sanction for his sweeping assertion (page 118) « Despite finesse and ingenuity their geometric mind is totally lacking. Rigorous exactness and ability for serious research are not to be numbered among the gifts of the gods. »

In spite of this fact, however, it should in all fairness be stated that the future is hopeful, and that the younger generation gives promise of developing, as the Japanese have done, a school of mathematical thought that will do great credit to the country.

(*University of Tokyo*).

YOSHIO MIKAMI.

Notes and Correspondence

Queries and Answers.

Edited by TENNEY L. DAVIS (Mass. Institute of Technology,
Cambridge, Mass.)

Answer No. 6. — I am puzzled by Professor DAVIS's Query 6 (*Isis*, 9, 425). I don't know why the *seventh* verse of the *third* chapter of the Revelation is a coincidence. But I do know that « verse seven » had no meaning for ROGER BACON, nor for generations after him. It was only ROBERT STEPHEN in the sixteenth century who divided the New Testament into our unhappy verses and published them in his Geneva Greek Testament of 1551. Before his time the nearest had been A. B. C. D. down the margin like our present Greek texts of PLATO. A nineteenth century Vulgate, which I have, still gives both these divisions — STEPHEN's verses and A. B. C. D. sections. Professor DAVIS can read all about this in SCRIVENER's « Plain Introduction to the Criticism of the New Testament », chap. III, § 10, vol. I, pp. 69 ff. of the fourth edition, 1894. (*Hartford, Conn.*). DUNCAN B. MACDONALD.

Query No. 11. — *The sea with a double bottom.*

HENNING LARSEN's essay entitled *Tvíbytna* (*Scandinavian notes and studies*, vol. 9, 18-20, 1926), has drawn my attention to a mediaeval conception entirely new to me. I would like to know whether it is equally new to other mediaevalists.

The most interesting Icelandic MS. of the Royal Irish Academy (23 D 43), edited by HENNING LARSEN but as yet unpublished, contains the following brief chapter on the depth of the sea (I quote LARSEN's translation, the Icelandic text may be found in his paper above-mentioned).

« Where the sea is deepest, it is nine hundred fathoms to the stone base. But below the sea is a stone base of sixty (fathoms), and below the stone base is a sea of sixty (fathoms), and below the sea is a stone base of a nail's thickness. »

In his commentary LARSEN refers to the Icelandic word *tvíbytna* (plural *tvíbytnur*), meaning « a bottomless lake or pit, in popular belief,

or thought to be in hidden connection with the sea », and also to the name of a Swedish lake Tväbottnetjärnen, the lake with two bottoms.

The Icelandic MS. dates from the second half of the fifteenth century, but much of its contents can be traced back to the Salernitan knowledge which had been introduced into Scandinavia chiefly by HENRIK HARPE-STRÆNG (first half of thirteenth century). However this notion of a sea with a double bottom seems to be specifically Scandinavian. In particular I do not remember having found it in any Salernitan writing.

February 14, 1928.

GEORGE SARTON.

Reviews

H. E. Stapleton, the late R. F. Azo, and M. Hidāyat Ḥusain. — *Chemistry in 'Iraq and Persia in the tenth century A. D.* Memoirs of the Asiatic Society of Bengal, vol. 8, pp. 317-418, Calcutta, 1927.

The first two authors of this very important memoir are not unknown to students of mediaeval chemistry, or at any rate ought not to be unknown, for they had already published in the same series three valuable papers : Sal-ammoniac, a study in primitive chemistry (vol. 1, pp. 25-41, 1905); Alchemical equipment in the eleventh century (vol. 1, pp. 47-70), containing the text of an alchemical treatise by AL-KĀTHĪ, with analysis and discussion (see my *Introduction*, vol. 1, p. 723); An alchemical compilation of the thirteenth century (vol. 3, pp. 57-94, 1910). H. E. STAPLETON is principal of Presidency College in Calcutta; his two oriental collaborators are teachers of Arabic, — AZO was instructor in Arabic, Board of Examiners Office, Fort William; M. HIDĀYAT ḤUSAIN, Shams-ul-'Ulamā', is professor of Arabic in Presidency College. Though this is not stated in the preface, I assume that AZO and ḤUSAIN's shares in this work were primarily philological, and that we owe more specially to STAPLETON the scientific interpretation of the texts in the light of occidental chemistry.

The present work is a very important contribution to the study of Arabic chemistry, though it is not by any means final, but rather in the nature of materials which will need further study. Thanks to the independent efforts of STAPLETON in Calcutta, JULIUS RUSKA in Berlin, and E. J. HOLMYARD in Bristol, our knowledge of Arabic chemistry has progressed considerably within the last ten years, and if their admirable activity continues at the same rate (or perhaps at an increasing rate with the help of disciples) we may expect to have a good knowledge of the subject within the next twenty or thirty years. Our present knowledge, it must be admitted, is still very fragmentary and uncertain.

The main texts studied are the two following : (1) AL-RĀZĪ's Madkhal al-ta'limī (Instructive introduction), probably composed c. 900 or before. The Arabic text is edited from the unique MS. belonging to the Nawwāb of Rāmpūr (5 1/2 pp., equivalent to about 12 ordinary octavo pages). This text is also published in English translation.

(2) AL-RĀZĪ's Kitāb al-asrār (Book of secrets). This larger alchemical

treatise, composed c. 920, is divided into three discourses. The first two discourses, dealing respectively with Substances and Instruments, are completely Englished; this is followed by fragments translated from the third discourse. The Kitâb al-asrâr is the Liber arcanorum or Liber secretorum Bubacarîs known to Latin mediaevalists. The translation is made from five Arabic Mss. with occasional references to the Latin text. (1)

The interpretation of these two texts of the end of the ninth century and the beginning of the tenth is made easier by the translation of two other texts, one somewhat later and the other, earlier.

(3) The chemical section of the Mafâtiḥ al-'ulûm (Keys of the sciences), an encyclopaedia compiled c. 980 by MUḤAMMAD IBN AḤMAD AL-KHWÂRIZMÎ. The authors of this English translation were apparently unaware of the existence of a German one by the late EILHARD WIEDEMANN (1911; see my *Introduction*, vol. 1, p. 660)

(4) Fragments of the Kitâb uṣṭuqus al-awwal (First book called the element of the foundation) of JÂBIR IBN ḤAIYÂN (second half of VIIIth century)

To these translations are added very elaborate notes, dealing with textual, archaeological or scientific difficulties, and a long introduction.

What are the scientific contents of these documents and chiefly of the first two ascribed to AL-RÂZÎ ? They contain, first of all, a very remarkable classification of chemical substances. I cannot do more than sketch it. AL-RÂZÎ divided all chemical substances into fundamental substances ('aqâqîr) and derivative substances. The first group was classified into : (a) earthly, (b) vegetable, and (c) animal. The earthly substances were, in their turn, divided into six groups : spirits, bodies, stones, vitriols, boraces, salts. He distinguished four spirits : mercury, sal-ammoniac, arsenic sulphide, sulphur; seven fusible « bodies » or metals : gold, silver, copper, iron, tin, lead, and khârşînî. For a special discussion of the nature of khârşînî, see chapter 7, pp. 405-408. The authors conclude that it was possibly zinc. Another suggestion was made by J. R. PARTINGTON in *Nature* (vol. 120, p. 243, 1927) — the identification of khârşînî with mercury.

In the second place, they give us descriptions of instruments and apparatus, at least thirty-seven types. These are dealt with in two groups : (1) instruments for melting metals; (2) those for the manipulation (tadbîr, pl. tadâbîr) of substances generally. The second group includes e.g., the cucurbit (qar') and alembic (ambîq) with a delivery tube. Four kinds of ambîq are mentioned.

STAPLETON's commentary on the alembic was new to me. He suggests

(1) J. RUSKA is preparing a critical edition of the Arabic text.

that it was probably derived from the cupping-glass (*mihjamah*) — from the Greek form of cupping-glass, nipple-shaped with lower half of narrower diameter, and hole at the top. « The introduction of a model of the cupping glass into alchemy was almost certainly due to magical association between living bodies and those of inorganic (as well as organic) origin. The cupping glass removed the blood in which the soul of the person was supposed to reside : while on the other hand the spirits of both inorganic and organic substances when heated were collected in the alembic. »

Finally, they describe various alchemical processes. These processes imply a theory, of which it is worth while to recall the fundamental principle (see pp. 326-327).

« From AL-RÂZÎ's almost complete silence on the subject of the 'Mercury-Sulphur' theory of the metals in both the *Kitâb al-asrâr* and the *Madkhal*, it is possible that he did not accept the teachings of his Master JÂBIR IBN HAYYÂN on this point; but he certainly followed JÂBIR to some extent in the alternative form of the theory, whereby substances were looked upon as being composed of potentially active matter (*jasad*) in combination with various proportions of 'Spirit' (*rûh*) and 'Soul' (*nafs*). Believing, as he apparently did, that the essential substance (*jawhar*) of all matter is the same, all that was necessary to effect transmutation was to bring about various changes in the proportions of the ingredients of any substance — probably in the direction of increasing the proportion of 'Spirit' (or colouring principle) and 'Soul' (oily or combining principle). This, in ordinary language, may be interpreted as meaning the removal of the excess of any constituent which was regarded as an impurity, so that obviously the first step was to purify the substances which it was decided to use as materials for the preparation of the two precious metals, viz.: gold, the metal of perfect composition, and silver, which was only to a slight degree less perfect. Then followed processes designed to reduce the purified substances to such a degree of disintegration and fluidity that their penetration into other bodies with which they were mixed was likely to be facilitated : the admixture of the substances, thus disintegrated, in the proper proportions : and finally the removal from the mixture of dissolved, or 'cerated,' substances of the excessive amount of moisture, or the element of water, which they had temporarily acquired, so as to bring them back again to the solid state. »

The main merit of AL-RÂZÎ's work, as compared with other alchemical writings, is « his rejection of magical and astrological practices, and adherence to nothing that could not be proved, by experiment and test, to be actual fact. In alchemical practice he tore away the veil of mysticism with which even JÂBIR had continued to conceal from public view the mass of chemical facts that had gradually accumulated in the Near East up to the middle of the eighth century. »

This leads us naturally to discuss the springs of AL-RÂZÎ's knowledge. The main one is to be found in JÂBIR's writings. The latter were partly derived from Hellenistic sources, and also possibly from Chinese and

Mesopotamian sources. With regard to the Chinese origin, i.e., KO-HUNG's *Pao-p'o-tzu* (first half of fourth century; see my *Introduction*, I, 355), STAPLETON is far too dogmatic. This whole matter needs investigation almost from the bottom up. The Mesopotamian or Harrânian (Sābian) origin is far more plausible. STAPLETON's argument in defense of that origin is based partly upon the mention of khārṣinî (zinc ?) among the metals, and upon other facts which it is not possible to recite here. This argument is much easier to accept now than it would have been a few years ago, because the recent investigations of R. CAMPBELL THOMPSON (1925, *Isis* 9, 147) and H. ZIMMERN (1925, *Isis* 9, 547) have made us realize the importance of early Babylonian chemistry. STAPLETON's conclusions on this point are worth quoting.

" All these items of evidence appear to point clearly to Harrân as another and most important source of AR-RÂZÎ's knowledge, and we are therefore led to the final conclusion that AR-RÂZÎ relied mainly on the temple science of the Sābians of Harrân for materials whereby he could check and, where necessary, modify the statements of his Master JĀBIR IBN ḤAYYAN. If this thesis be accepted, and if, moreover, we recall the meaning of the word khārṣinî (arrowheads of China, otherwise known as ḥadid aṣ-ṣinî, or Chinese iron) we may further visualise Harrân — the ancient Carrhae, and traditional birthplace of the ultimate founder of three of the world's greatest religions — as the focus at which had collected, and from which was again disseminated, all the knowledge of the ancient East. Lying as it did on the direct road between Syria and the Far East, as well as being the spot where the high road from Asia Minor, through the Hittite frontier-outpost Carchemish, joined the Damascus-Nineveh road, it is easy to understand how, on the one hand, it may, as the name khārṣinî indicates, have had, at some period of its history, an intimate connection with China, while, on the other, as the cult of Hermes and Agathodemon indicates, Harrân certainly established a close relationship with both Greek as well, probably, as the most ancient Egyptian civilisation. As two of us pointed out in a previous paper the very name in Chaldaean was taken, in the time of the tenth century bibliographer AN-NAḌĪM, to indicate that Hermes was the High Priest of the Temple of Mercury in Babylon; while he was believed to have subsequently moved to Egypt where he died and was buried under the Great Pyramid, after revealing to mankind the Art of Alchemy. We need not enter into a discussion as to the precise truth of this attribution of the original civilisation of Egypt to early Mesopotamian (i. e. Sumerian) civilisation, though it more or less agrees with the present views of Egyptologists. The main point to emphasize is that, in all probability, Harrân was the meeting place of all the civilisations of the ancient world, Greek (and even Minoan), Hittite, Egyptian, Mesopotamian, Persian and Chinese, and that, ultimately, through Harrân, this synthetised knowledge passed on to the Arabs, and thence into the ken of the modern world. "

STAPLETON's views on Harrânian culture may be compared with those expressed in my review of WALTER SCOTT's *Hermetica* (*Isis* 8, 345); they are very interesting, but the reader will please bear in mind their speculative nature.

There is still one point of the author's conclusions which deserves emphasis, namely, the one concerning the possibility of an Indian influence. I quote two extracts of his memoir relative to this (p. 343; p. 402).

"With regard to the extent and influence of Indian alchemy, previous association with Sir P. C. RAY as our valued colleague would alone have led us to extend our enquiries in the hope of supporting his views on the subject. We regret, however, that we have been forced to conclude from a comparison of the facts that are brought to light in this paper with those given in the two volumes of his 'History of Hindu Chemistry', that the earlier, and possibly autochthonous, system of Indian alchemy based almost entirely on the use of vegetable juices, was superseded sometime between 500 and 1000 A. D. by a system of external origin which was primarily based on the use of mercury. Far from discovering any corroboration of the theory that Indian thought radically influenced the development of Western alchemy, we find AR-RÂZÎ — who was acquainted with both SUSHRUTA and CARAKA, and, possibly, even made use of them in his medical works — curtly dismissing the possibility of vegetable alchemy in the sentence 'The Sages paid very little attention to vegetable substances and very seldom used them (in alchemy).' We believe that when all the facts have been reconsidered — particularly those in relation to the now-proven use of mercury in the religion and alchemy of Mesopotamia and China from at least the beginning of the Christian era to the time of AR-RÂZÎ — it will be necessary to admit that most of the knowledge regarding metallic and inorganic chemistry that has been so carefully collected by Sir P. C. RAY from Indian treatises on alchemy actually originated from outside India. '...the use of mercury must have been introduced into India from elsewhere. This is proved by the fact that quicksilver is nowhere found native in India, and that it is explicitly stated to have been brought from the country of Darada, or Parada, somewhere outside of India. On the other hand, mercury and its most important compound, mercuric sulphide, was known and used in Europe, the Near East, and China, for hundreds of years before the first mention of it appears in Indian medical works. In China, particularly t'ân shâ, or mercuric sulphide, was regarded as the 'Elixir of Life' from at least 200 B.C. (vide HANBURY, 'Notes on Chinese Materia Medica,' *Pharm. Journ.*, II (1860-61), p. 114). It is all the more necessary to emphasize this, as very recently Sir P. C. RAY, in strange disregard of the mass of published work on the subject, including the striking evidence of the actual texts of his own 'History of Hindu Chemistry,' has again stated that the knowledge of pharmacy which the Arabs brought to Europe — especially the use of mercury and its chief compound, mercuric sulphide — was derived from the Hindus (vide 'Makers of Modern Chemistry,' p. 90)."

This long analysis has not by any means exhausted the rich material contained in this memoir, but I have said enough to underline its importance. Every historian of early chemistry will have to refer to it. Its only blemish is the absence of a glossary, an absence which is especially regrettable because of the great number of technical terms, many of them unusual, which are mentioned. Aside from that, there cannot be anything but praise for this work, even if one cannot yet fully share the author's enthusiasm for AL-RÂZÎ. To compare the latter with GALILEO

and ROBERT BOYLE is not yet warranted, but if such comparison should stimulate the further investigation of AL-RÂZÎ's writings and of other Arabic treatises on chemistry, we would be the last to complain.

GEORGE SARTON.

Avicennae *De congelatione et conglutinatione lapidum*. Being sections of the Kitâb al-shifâ'. The Latin and Arabic texts edited with an English translation of the latter and with critical notes by E. J. HOLMYARD, Head of the Science Department, Clifton College, Bristol, and D. C. MANDEVILLE, Clifton College. ix + 86 p. Paris, PAUL GEUTHNER, 1927.

No Greek text has ever been found of the book on metals or on stones which ARISTOTLE distinctly promised in the third book of the *Meteorologica*. On the other hand a Latin text, *Liber de mineralibus* ARISTOTELIS, has long been known and considerably discussed. F. DE MÉLY (1894) and others considered it a translation of a genuine Aristotelian writing, others asserted that it was not Aristotelian but Avicennian. The truth of the matter seems to be that the *Mineralia* is partly a direct translation and partly a summary of the alchemical sections of the *Kitâb al-Shifâ'* (Book of healing) which IBN SÎNÂ composed c. 1022. More specifically : « The Latin rendering is divided into three chapters, viz. *de congelatione et conglutinatione lapidum* (a title by which the whole work is often known); *de causa montium*; and *de quatuor speciebus corporum mineralium*. The first two of these are translations, full or abridged, of section 1 of Discourse 11 of subject (fann) V of the physics of the *Shifâ'*. The third, *de quatuor speciebus* is a translation of section 4 of the same Discourse. Fann V as a whole consists of two Discourses (maqâla) upon meteorological phenomena understood in the Aristotelian sense of the term, sections 1 and 4 dealing with topics which ARISTOTLE would no doubt have treated in the fourth book of his *Meteorologica* if he had ever completed it.

It will be recalled that the first three books of the *Meteorologica* were translated by GERARD OF CREMONA from the Arabic; the fourth book was translated from the Greek by HENRICUS ARISTIPPUS. To the fourth book were added the three chapters which form the subject of the present edition, and those chapters were translated by ALFRED OF SARFESHEL c. 1200 (rather before than later).

To indicate the scientific interest of IBN SÎNÂ's mineralogy, it will suffice to quote the following paragraph from the introduction (p. 11) : « IBN SÎNÂ's opinions upon the formation of stone, rocks and mountains are remarkably interesting, in that they show an astonishingly accurate insight into geological phenomena. They are so clearly and concisely expressed that we have felt it unnecessary to give a synopsis, preferring that IBN SÎNÂ should be allowed to speak for himself. Similar remarks

apply to his theories upon the nature of minerals, and particularly to his ruthless criticism of the alchemists and their attempts to transmute the base metals into gold. On the latter subject he was taken to task by the celebrated vizier AL-ṬUGHRĀ'ī, who wrote his *Ḥaqā'iq al-istishhād* with the definite aim of refuting the heretical opinions of the *Shifā'*. The arguments of the *Ḥaqā'iq al-istishhād* are of the usual type, so that no good service would be performed in reproducing them here. IBN SĪNĀ appears to have made up his mind only late in life; it is possible that at an earlier period he actually wrote books in favour of alchemy. However this may be, he had, in the *Shifā'*, given the alchemists a blow the repercussions of which were felt throughout many succeeding centuries—the passage beginning *Sciunt artifices alchimiae* is quoted innumerable times in mediaeval alchemical literature. »

The present publication contains a critical edition of the Arabic text by HOLMYARD, a copy of ALFRED's translation, and an English translation of the Arabic text. A number of valuable notes, philological and technical, are added to this translation. My only regret is the lack of a technical glossary. There is no excuse for omitting it. The editor could have compiled it in a short time, and would thus have saved considerable time and trouble to the scholars using his book or planning to edit similar texts. It would have hardly added to the cost of this otherwise excellent publication, and would have materially increased its usefulness. It is foolish to omit a thing which costs little and produces much. The reference to IBN SĪNĀ's *Kitāb al-hudūd* is a poor consolation for the scholars who can not easily obtain the Arabic text, nor even consult ALPAGUS's Latin translation in the Venetian edition of AVICENNA.

GEORGE SARTON.

Marco Polo. — *Il Milione*. Prima edizione integrale a cura di LUIGI FOSCOLO BENEDETTO sotto il patronato della città di Venezia (Comitato Geografico Nazionale Italiano, Pubblicazione N. 3). ccxvii + 283 pp., ills., (part colored), index. LEO S. OLSCHKI, Florence, 1928.

This new edition of MARCO POLO constitutes the third number of the important *corpus* of Italian travelers now being published by the Comitato Geografico Nazionale Italiano (1). It forms a magnificent volume

(1) The first two numbers are R. ALMAGIÀ, « L'Italia » di GIOVANNI MAGINI e la cartografia dell'Italia nei secoli XVI e XVII, 183 pp. 9 maps, Società anonima editrice FRANCESCO PERRELLA, 1922 (see *Isis*, 6, 164) and a cooperative work, *L'opera degli italiani per la conoscenza dell'Egitto e per il suo risorgimento civile ed economico* : scritti di vari autori raccolti e coordinati a cura di ROBERTO ALMAGIÀ, xv + 200 pp., index, Provveditorato generale dello stato libreria, Roma, 1926.

(35 × 25 cm.), clearly printed on good paper and illustrated with reproductions from illuminated manuscripts (some in color).

It is hardly an exaggeration to state that no more fundamental piece of research has ever been undertaken in the entire field of the history of geography. We have here a critical text of the *Milione*. An elaborate introduction of over 200 pages presents an analysis of the textual problem, revealing the deficiencies of the older editions. In this connection, even the edition of Sir HENRY YULE, splendid monument of scholarship that it is, does not escape severe stricture. YULE and other specialists in questions relating to MARCO POLO have been more proficient in Oriental geography and history than in Romance philology and textual criticism. Hence their work has, in places at least, been built upon foundations of sand; as Professor BENEDETTO says: «treasures of erudition have been thrown away in the illustration not of the thought of MARCO POLO himself but of the errors of his copyists.» YULE's influence in certain respects has even been positively detrimental, in that it has given rise to the illusion that there was little or nothing more to be done.

MARCO POLO, as is well known, was captured and imprisoned by the Genoese after his return from Asia. A fellow prisoner, whose name BENEDETTO believes to have been RUSTICHELLO (not RUSTICIEN, as hitherto supposed) of Pisa, wrote down the traveler's narrative in French. The picturesque story of POLO's having dictated his adventures seems to be wholly without foundation; Professor BENEDETTO thinks it more likely that RUSTICHELLO made use of POLO's notes.

To what extent do the texts of existing manuscripts and early printed editions correspond to the original version written by RUSTICHELLO? Unfortunately the very oldest extant French manuscripts are removed from this original by several links missing from the chain of descent — how many it is unknown. Furthermore, in certain Latin translations statements are found for which MARCO POLO himself was undoubtedly responsible but which do not occur in the French manuscripts. The whole question is enormously complex, but of sufficient importance to justify a brief analysis, even at the risk of over-simplification.

One of the most famous POLO manuscripts, written in old French «profoundly and variously contaminated by Italian influences,» is that of the Bibliothèque Nationale, Paris, No. 1116 (Anc. 7367). Here the phraseology in many passages closely resembles that found in certain Arthurian romances known to have been the work of RUSTICHELLO of Pisa. Identical words and turns of expression are often employed, as, for instance, those describing such very different occurrences as Sir Lancelot's arrival at King Arthur's court and that of MARCO POLO at the court of the Grand Khan. Other passages reveal a Venetian impress and are probably to be ascribed to the direct influence of the traveler

himself. This text, designated F by BENEDETTO, was inaccurately transcribed by J. B. G. ROUX DE ROCHELLE in the edition published by the Société de Géographie of Paris in 1828 and has subsequently been known as the Geographic Text. BENEDETTO prints it as the basic text in his edition.

There is another important group of French texts (BENEDETTO's FG) derived from a fourteenth century version—a sort of translation into « more orthodox » French made by one GREGORY. Certain manuscripts in this group include a statement that the copy from which they were adapted had been received in Venice directly from MARCO POLO himself by THIEBAULT, Seigneur de Cepoy, in 1307. In view of the fact that elsewhere in this same text the date of the original composition is given as 1298, the argument was elaborated by PAULIN PARIS in the middle of the last century that the copy on which GREGORY based his adaptation was a « second edition revised and corrected » by MARCO POLO and that FG was thus a closer approach to POLO's own thought than any other text, including F. G. PAUTHIER accepted this view. His well-known French edition (1865) was constructed in the main from a manuscript of this Gregorian group.

Shortly after the appearance of PAUTHIER's edition G. BIANCONI demonstrated that certain passages in FG arose from misunderstandings of passages correctly given in F. BENEDETTO surmises that both F and FG were derived from a common original model and demonstrates that FG is, if anything, farther removed from MARCO POLO's thought than F. This, of course, deprives PAUTHIER's text of its authority. Indeed, owing to the limited use of manuscripts by its editor, PAUTHIER's edition, in Professor BENEDETTO's view, is both inadequate and misleading. That it continues to be « un ingombro pericoloso », BENEDETTO observes in a footnote, is proved by the fact that A. J. H. CHARIGNON has rendered it into modern French in an elaborate edition now being published at Pekin (see *Isis*, vol. 11). Although YULE was aware of the imperfection of PAUTHIER's edition he nevertheless employed it as the basis for his English translation, correcting it in places by comparison with the Geographic Text and adding in parentheses passages from RAMUSIO's version.

The most striking part of BENEDETTO's argument is the demonstration that in the Italian version of G. B. RAMUSIO dating from the middle of the sixteenth century and in certain Latin manuscript versions which have been unknown to all previous students of the *Milione*, there is a considerable quantity of material of undeniably Polian origin not found in either F or FG. This material, therefore, must have come from an even older version than that from which F and FG were more immediately derived. RAMUSIO asserts that he used an extremely old manuscript

which was perhaps copied from the original manuscript of MARCO POLO. BENEDETTO had the good fortune to discover in the Ambrosian Library at Milan a hitherto unknown manuscript (Z) containing some of the untraced passages in RAMUSIO as well as new passages undeniably of Polian provenance. Although fragmentary, so far as it goes, Z is more authentic as well as more detailed than F.

The importance of Z is illustrated by the following circumstance. It has been wondered why MARCO POLO fails to mention Kara-Khoto, a city in central Asia near his route of march. Furthermore, it has been thought peculiar that he neglects to comment upon certain customs of the Chinese people that surely must have seemed very strange to him. Z, however, contains both a description of Kara-Khoto and a long account of Chinese manners and customs as well as much other material that is found nowhere else and can be ascribed only to MARCO POLO.

BENEDETTO uses the F version as the basis of his text, but at the bottom of each page appends all the variant or additional passages of Polian origin from Z and from RAMUSIO.

With the text thus established, let us hope for the appearance in the near future of a translation from Professor BENEDETTO's version.

(New York City).

J. K. WRIGHT.

Roger Bacon. — *The Opus Majus*. A translation by ROBERT BELLE BURKE, Professor of Latin and Dean of the College, University of Pennsylvania. 2 vols. xiv + 840 pp., 8 pl. University of Pennsylvania Press, Philadelphia 1928. (Published March 2, 1928; \$ 10.00).

GUY DE FOULQUES, who became pope under the name of CLEMENT IV (1265-68), had been secretary to SAINT LOUIS. The greatest part of his life was spent in France, but he was in England at the time of his election to the pontifical throne. While in Paris, and perhaps also while in England, he had many opportunities to hear of the admirable yet much-discussed activity of an English Franciscan, ROGER BACON, and soon after he had reached Rome, he addressed a letter in 1266 to the said BACON, directing him to send copies of all his writings without delay. ROGER BACON had not written much thus far, but being greatly stimulated by the Pope's interest, he proceeded to compose in full haste expositions of his doctrines; and two years later, in 1268, he dispatched three new works to CLEMENT IV, the *Opus majus*, the *Opus minus*, and the *Opus tertium*, together with a copy of an earlier one, *De multiplicatione specierum*. Unfortunately, the Pope died a few months later, and it is doubtful whether he was able to consider BACON's works, and even whether he received them.

The *Opus majus* is undoubtedly one of the greatest Latin treatises of the Middle Ages. Scholars are not agreed in their appreciation of it; uncritical praise has been naturally followed by a reaction; it is clear

now that ROGER BACON was not by any means as original and as modern as early admirers would have it. One would hesitate to repeat BRIDGES's encomium (1). « Combining the comparative study of language with a comprehensive grasp of physical science, conceiving these studies as progressive, and yet holding them subordinate to a supreme ethical purpose, the *Opus majus* surpassed any that was put before the world till the publication of the philosophical and social works of AUGUSTE COMTE. » And yet there was considerable truth in that. ROGER BACON had unquestionably some limited understanding of experimental science, and he fully realized the dangers and sterility of scholasticism, he understood the need of a better study of languages, finally he was deeply convinced of the unity of knowledge. To be sure, he was not the first to feel that unity, but the new emphasis which he laid upon it had the value of an original contribution. As he put it in his *Opus tertium* : « Omnes scientes sunt connexae, et mutuis se fovent auxiliis, sicut partes ejusdem totius, quarum quaelibet opus suum peragit non solum pro se sed pro aliis. » And then consider the architecture of his *Opus majus*; was it not splendid ? Let me just recall the main features of it.

It is divided into seven parts, as follows.

I. *Causes of error.* Four chief obstacles in grasping truth : submission to faulty and unworthy authority, influence of custom, popular prejudice, and concealment of our own ignorance — Experience and authority.

II. *Philosophy.* Theology the exposition of divine truth made through the sciences — The wisdom of philosophy is the wisdom of God — Unbelieving philosophers and poets : early Greeks, ARISTOTLE — The patriarchs and prophets — Philosophy completed by Christian faith.

III. *Study of Tongues.* Reasons why Latins should know other languages — Hebrew and Greek pronunciations — Corruptions and false interpretations of the Scriptures — Knowledge of languages necessary to the Church.

IV. *Mathematics.* Logic and science as related to mathematics — Multiplication of species as regards lines, angles, and figures — Natural action explained by geometry — The light of the stars — Climate — The tides — The infinity of matter — The shape and extent of the universe — The unity of time — Motion — Application of mathematics to sacred subjects — Astronomy — The calendar — Music — Numbers — The distances of the heavenly bodies from the earth — Astrology — The correction of the calendar — The habitable world — Known parts of Asia, Africa, and Europe — The influence of the sun, planets, and stars on the earth.

V. *Optical Science.* Imagination, the common sense and memory — Optic nerves and the structure of the eye — Perception — Light, distance, rarity of the medium, and the position, magnitude, and density of an object in relation to sight — Errors of vision : the shape of the moon, the scintillation of the stars — Reflection and refraction.

VI. *Experimental Science.* Proof through experience — External and internal experience — The utility of experimental science : analysis of the rainbow, concept

(1) *Opus majus*. Supplementary volume (London, 1900, p. V).

of an astrolabe, the possibilities of medical science — Experimental science in relation to theology.

VII. *Moral Philosophy*. 'The science of the salvation of man — Man's duty to God, to his neighbor, and to himself — The meaning of God — Angels — The immortality of the soul — Four hindrances to a knowledge of eternal life : sin, care of the body, trammels of the sensible world, lack of revelation — The worship of God — Laws and statutes regulating human relations — Personal conduct — Twelve virtues according to ARISTOTLE — Other definitions of virtue — Discourses on sin — Contempt for prosperity and sensual pleasures — Remedies for anger — Endurance of adversity — Thoughts from SENECA and OVID — Comparative religions — Essence of the First Cause is infinite — CHRIST the perfect lawgiver — Acceptance of the Sacrament.

Considering the importance of this work it is very surprising that it remained unpublished until 1733, when SAMUEL JEBB gave an incomplete edition of it (London, 1733). An improved edition appeared in Venice, 1750, but neither this nor the first edition contained the seventh part, the ethical crown of the Great Work. The English positivist, JOHN HENRY BRIDGES, gave a better edition in 1897 (2 vols.), but he had presumed on his scholarship when he undertook it, and this edition was sadly deficient in many respects. He published a supplementary volume in 1900, containing many additions and corrections, and the whole work was then abandoned by the Clarendon Press and transferred to WILLIAMS and NORGATE. The story of this disaster and of BRIDGES's noble way of repairing it as well as he could is movingly told in SUZAN LIVING's biography of him (1926; *Isis*, 10, 208). BRIDGES's edition is inconvenient, as one is always obliged to consult the supplementary volume, but it contains a detailed analysis in English and a good index.

The English translation, now handsomely published by the University of Pennsylvania Press, was made by Dean BURKE, apparently with great care. I have compared with the original text a few passages taken at random, and have found them to be very accurate, if somewhat heavy. But one reads BACON for the sake of his thoughts rather than for his style, and one can hardly expect awkward Latin to be transformed into fluent English. This translation is followed by an elaborate index. Thus henceforth it will be very easy for English readers either to read the *Opus majus* or to refer to it, and for this we owe some gratitude to the translator and the publishers.

Yet it is a great pity that they left this work unfinished in another important respect. It is clearly impossible for an inexperienced reader to appreciate BACON's work on the basis of this translation. From this point of view, BRIDGES's edition will still be more useful to him than BURKE's version, for it contains a number of valuable notes. How can the reader know what is original to the Doctor mirabilis, and what is not? No such translation can be deemed complete which does not

contain sufficient footnotes to indicate, however briefly, the source of each statement. Of course, this would require considerable research, but it is only when that is done that we shall consider the *Opus majus* properly edited. The University of Pennsylvania Press ought to have done that, but it is not too late yet; let us hope that it will soon give us these footnotes in a separate volume.

In short, for a proper study of the *Opus majus*, we need a new edition of the Latin text, which may be read consecutively; in the second place, the present translation must be completed by a volume of scientific notes. When that is done it will be a little easier to appreciate correctly the work and personality of BACON. At the present time there is not yet a single biography of him that is entirely satisfactory to the historian of science. All that we have is the following: ÉMILE CHARLES. BACON (432 pp., Paris, 1861) — BRIDGES's introduction to the *Opus majus* (1897; improved edition, published in 1914). This is valuable but insufficient. BRIDGES's knowledge of mediaeval science was rudimentary. — The BACON essays edited by A. G. LITTLE (Oxford, 1914) to commemorate the seventh centenary of BACON's birth contain very interesting materials. — LYNN THORNDIKE has devoted considerable space to BACON in his *History of Magic* (vol. 2, 1923, 616-691), but his account is not complete from the scientific point of view, nor is it unprejudiced. THORNDIKE is the leader of the anti-Baconian reaction, but I believe he has gone too far. There are many other studies dealing particular subjects (see my *Introduction*, vol. 2), but we need a synthesis; we need it not only for the sake of BACON, but, even more, to make possible a correct judgment of the knowledge available in the second half of the XIIIth century.

The most urgent task is to complete this excellent translation by the scientific notes without which there is not one scholar in a thousand who can really understand BACON's *Opus majus* and appraise its true merit.

GEORGE SARTON.

William Romaine Newbold (1865-1926). . . *The Cipher of ROGER BACON*. Edited with foreword and notes by ROLAND GRUBB KENT. XXXII + 224 pp., 33 pl. Philadelphia, University of Pennsylvania Press, 1928 (Published March 23, 1928; \$ 4.00) .

The well-known bookseller, (1) WILFRID M. VOYNICH, purchased in or about 1912 « in an ancient castle in Southern Europe » the manuscript which is the subject of the present publication. This manuscript was given in 1665 (or 1666) by MARCUS MARCI of Prague to ATANASIUS

(1) The author calls him « bibliophile. » Well, I trust Mr. VOYNICH is a bibliophile, but he is primarily a bibliopole. The use of the word bibliophile in this case is deliberately misleading.

KIRCHER. MARCI's Latin autograph letter contained the following statement : « Dr. RAPHAEL, tutor in the Bohemian language¹ to FERDINAND III, then King of Bohemia, told me said book had belonged to the Emperor RUDOLPH and that he presented to the bearer who brought him the book 600 ducats. He believed the author was ROGER BACON, the Englishman. On this point I suspend judgment; it is your place to define for us what view we should take thereon. » As the margin of the first page bears the name of JACOBUS DE TEPENECZ, we may assume that the Ms. was once the property of this Bohemian scientist, who, before 1608, was known as HORCICKY (or SINAPIUS). JACOBUS may have obtained it from the emperor RUDOLPH II, but this is a mere guess; the history of this Ms. before 1608 is entirely conjectural. It is a small quarto (nine by six inches) of 246 pages, written in cipher, and containing many illustrations.

« To judge from the drawings, the contents of the manuscript fall into five divisions. The first and largest section contains the equivalent of 130 pages, 125 of which bear drawings of plants with accompanying text; this I term the botanical division. The second contains 26 pages of drawings, obviously astronomical or astrological, but of striking originality, few presenting any resemblance to the innumerable extant drawings relating to the same subjects. The drawings are accompanied by numerous legends, but little continuous text. The third section is still more strikingly original in character; it contains 4 pages of text and 28 of drawings, to which no parallels of any sort are known. Some persons perhaps would term them 'weird,' 'bizarre,' 'uncanny,' but neither these nor any other adjectives seem to me appropriate. Yet, strange as they are, they are not lacking in artistic quality; the nude little female figures with which every page is peopled are rudely drawn indeed, but there is about them a fresh vividness, an expressiveness, which places them at a wide remove from the stiffly conventional figures of contemporary miniature painting. The leading topic dealt with in this section is the procedure by which the soul becomes united to the body; I term it 'biological.' The fourth division contains on 34 pages drawings of flowers, fruits, leaves, roots, and of the receptacles used by pharmacists for their duties; it is almost certainly pharmaceutical in character. The fifth division contains 23 pages of text, arranged in short paragraphs, each beginning with a star. The 24th page of this division, the last of the manuscript, contains the Key only »

The late Professor NEWBOLD undertook to decipher this mysterious manuscript. He was just the sort of scholar to undertake this repelling task. As his editor tells us, « even as a boy he was attracted by strange alphabets and puzzling methods of writing. He was thrilled by LAYARD's Nineveh; he copied with a stylus on soft clay a cuneiform text there pictured, baked the tablet in the kitchen oven, and buried it in a field, where some day it may be found and held as proof of an Assyrian conquest of Northern New Jersey. He taught himself to read the Hebrew Old Testament... » During the last years of his life he devoted considerable time to the BACON manuscript and to the Great Chalice of Antioch

« supposed by some to be the actual Chalice of the Last Supper, the Holy Grail of legend... » After long investigations, he concluded that the manuscript was written in characters which were themselves made up of microscopic characters, based mainly on ancient Greek shorthand. The cipher was extremely complicated but, if I understand the author's and the editor's explanations, it was rather flexible, so that a group of letters could be interpreted in various ways. For technical details I must refer the reader to NEWBOLD's book, but the following extract may be quoted to illustrate the extreme difficulty and the arbitrariness of his task.

« But such is the craft, may I say the infernal craft, of the dear old soul, that long after I had his alphabet and his system I could not read a word with any assurance that it was right. And I haven't yet mastered all his tricks, although I know a great many of them.

« *Deception* is the keynote of the whole. Nothing is what it seems to be. His beautifully written characters are all shams. They look like *a, s, m, n*, and so on, but they are nothing of the kind. Nearly every one is built up with amazing skill and ingenuity out of microscopic shorthand characters. He was the only man on earth possessed of a good microscope, and he relies upon it as part of his apparatus of concealment. I have long known the fact that his letters were built up out of significant elements and had been using an ordinary reading glass to help resolve them, but only about four months ago, when it occurred to me to turn a pretty strong microscope upon them, did I discover that nearly all the letters which I had been taking as wholes were really perfect nests of tiny characters.

Mark the « good microscope, » which is truly symptomatic. A scholar of NEWBOLD's type stops at nothing, — and thus we may expect him to obtain almost any results ! Witness his descriptions of two of the pages reproduced in facsimile in his book.

« Plate V. Page from the biological section : folio 78 recto. Upper corners schematized ovaries (nucleated ova); (Fallopian) tubes opened to show stream of ova descending into cavity (uterus), in which are seven souls or spirits (spermatozoa), three not yet awakened to consciousness, four expressing surprise and horror at their environment. Below, eight spermatozoa have discovered a 'nest' of eight ova and view their destined dwelling places with expressions of surprise and curiosity, not unmixed with disgust. »

« Plate VIII.... This and several other of the disks have a marked general resemblance to magnified sections of a fertilized ovum, but the resemblance in detail is not close enough to warrant identifying any one of them with any particular stage of development as seen through modern microscopes. The combination, however, of these anatomical symbols with other symbols of a different character leaves no doubt that the series as a whole is intended to symbolize BACON's theory of the development of the ovum, especially of the influences which are brought to bear upon it. BACON held that six factors are concerned in the generation of the organism : (1) the seed of the female, which supplies the matter, (2) the soul of the male which, operating through (3) the seed and (4) by means of the 'spirits,' a species of vapor or gas produced by the seed, gives form to that matter, not

however without the coöperation of (5) the soul of the female, (6) the united influence of the heavenly bodies, especially the sun, which controls the entire process. All of these factors may be recognized in the drawings. 'The seed of the female is represented by the cell rings in five of the disks; the male seed by an object resembling the head of a spermatozoön embedded in one of the disks (the same object occurs elsewhere in a context which requires the same interpretation); curious wave-like formations in two of the disks may well symbolize the 'spirits.' The celestial influence operates from the corners, its effects on the ovum is represented by masses of stars pouring into or massed within the disks, and by pictures of a church, a castle, and more modest dwellings inside one of the disks. It is also probably represented by symbols resembling those used in the astronomical section for the divisions of the sky, which are seen within two of the disks. The souls of the parents, which 'excrete the seed,' are not here represented but are shown on Plate VII. "

Still another page is interpreted by him as being a drawing of the great nebula of Andromeda which can "at present be detected by photographs only; it is not visible even in the most powerful telescopes. "

When a man is as utterly devoid of critical sense as NEWBOLD proved himself to be, there is no limit to the eccentricities which his mind may conceive. I do not doubt a moment his honesty; I am willing to admit that he was not a deliberate impostor, but he was undoubtedly, to put it as gently as possible, a self-deceived enthusiast. However, the most astonishing and painful thing to me is not the erratic activity of a NEWBOLD, but the readiness of so many people to be fooled by him. This is not the first example of pseudo-science or pseudo-scholarship. In every case the deception would have been almost impossible but for the unconscious complicity of a crowd of people who are so fond of mystery that they are at the mercy of every impostor or crank having enough skill, plausibility and persistence.

I have devoted far more space to NEWBOLD's work than it deserved. I have done so because my shorter note relative to it, apropos of JOHN M. MANLY's criticism (1921, *Isis* 4, 404), has apparently been insufficient. I was hoping then that this idiotic thing might be averted, but now that it has been published in book form, and so handsomely published, a new stream of evil has been started which will work mischief for ages to come. We may be sure that there will be enough cranks to continue the new kind of aberration originated by NEWBOLD, and enough misguided occultists and muddle-headed people of various kinds to stimulate them. Henceforth when we shall speak of Baconian fools, we shall have to distinguish between two groups of such fools, the Francis Baconians and the Roger Baconians.

The author of this extraordinary book, WILLIAM ROMAINE NEWBOLD, was born in 1865 at Wilmington, Delaware. He studied at the University of Pennsylvania, and became an instructor there in 1889; the rest of

his life was spent in the service of his alma mater, as a teacher of philosophy. He died in Philadelphia, in 1926. He wrote a great many papers on psychological, philosophical, philological and archaeological subjects, but unfortunately he will be mainly remembered because of his interpretation of this so-called Baconian manuscript. Thus his main bequest to mankind is not of a positive but of a negative nature, for in his opus majus he did not leave us new truths but new errors and delusions. However, we have every reason to assume that he was thoroughly honest; may he rest in peace!

More information on the author may be found in a booklet, edited by R. G. KENT, entitled *NEWBOLD Memorial Meeting* (30 pp., with portrait and bibliography, University of Pennsylvania, Philadelphia, 1927).

GEORGE SARTON.

Ellen Scott Davison (1864-1921). — *Forerunners of Saint Francis and other studies*. Edited by GERTRUDE R. B. RICHARDS; with a foreword by JAMES T. SHOTWELL. XVI + 425 p., portrait. Boston, HOUGHTON MIFFLIN, 1927 (five dollars).

The largest and most important part of this book is a study of the successive waves of Christian discontent and reform which preceded the establishment of the Mendicant Orders at the beginning of the thirteenth century. These waves succeeded each other with increasing speed and strength during the eleventh and twelfth centuries. The causes were many: the slow disintegration of feudalism, the growth of cities, the appearance of new social classes; then also the slow but steady diffusion of knowledge, finally the crystallization of the Church, the culmination of its temporal power, its gradual loss of spiritual vigor. The ideals of primitive Christianity seemed more and more distant and yet the very churchmen who appeared to forget them were obliged to fan Christian endeavor in order to insure the success of the Crusades. Put all these things together: economic distress or discomfort, intellectual fermentation, conflicts between spiritual aspirations and clerical formalism, Crusading revivals. It is natural enough that many of the best men and women were inspired anew by the teachings of the Apostles and especially by the ideal of evangelical poverty. Never was the discipline of the Church more often questioned than during the two centuries which prepared the coming of ST. FRANCIS. Miss DAVISON has admirably told the main events of this period of religious fermentation. She explains the foundation of the Carthusian order in the Dauphiné, the efforts of the Good Men of Grammont in Limousin, the establishment of the Cistercian Order in Burgundy, and that of the Praemonstratensians in the Ile-de-France, the activity of ARNOLD OF BRESCIA and his followers in Rome, of the Humiliati in Lombardy, of the Poor

Men of Lyons, of the Waldensians in Piedmont, S. France, Germany, of the Cathari and their kindred almost everywhere. Her account is always based upon the best available information and contains all the needed references. It is well thought out and pleasantly written, and is inspired throughout by genuine sympathy for all concerned. She gives us incidentally excellent portraits of the main protagonists : the German ST. BRUNO; the Frenchmen ST. ETIENNE OF MURET, ROBERT OF MOLESME, ST. BERNARD, PETER WALDO; the Italian ARNOLD OF BRESCIA; even an Englishman, and a great one, STEPHEN HARDING; and this curious ST. NORBERT. the founder of the Order of Prémontré, so full of inconsistencies and yet so well balanced, who hailed from the little Duchy of Cleves. The last personality is that of ST. FRANCIS, but we are given of him only a tantalizing glimpse.

Why did ST. FRANCIS succeed while so many of his saintly predecessors were driven into rebellion and heresy? Why have the Mendicant Orders triumphed? To be sure, the Carthusians, Cistercians and Premonstrants succeeded too, but to a much smaller extent. The others failed completely. Why? After reading Miss DAVISON's clear and wise account and connecting it with my own knowledge of the subject, with my own thoughts and impressions, I have satisfied myself that ST. FRANCIS's success was due only in part to his own genius. ST. FRANCIS succeeded partly because many others had failed before him. Their failures had taught him and others what to do and what not to do. By others, I mean the Curia. By the beginning of the thirteenth century it must have been clear to the Church that the enthusiasm for evangelical poverty was too genuine and too wide-spread to be checked. The fact that it was INNOCENT III (1198-1216) who ordered the Crusade against the Albigenses may give us of him a very wrong idea. In fact he showed in these critical days an unusual amount of wisdom and fatherly kindness. He « realized that the Church, beset by enemies who fought for conscience's sake, needed to organize all of the enthusiasm and religious zeal she could command within her own ranks ». Children (and most men are children) must be assumed to be good, as long as they have not proved themselves unquestionably bad. It was foolish to drive wayward but good children into heresy. It was easier to see the faults of the clergy than to remedy them. Many of the reformers were exceedingly ignorant, and thus « doctrinaire »; it was difficult to discuss with them, yet they were good, perhaps better than their opponents. It was necessary to handle discontented Christians with considerable tact and kindness. INNOCENT III conciliated the Humiliati, or at any rate some of them; he even conciliated the more orthodox of the Waldensians, the so-called « Poor Catholics »; if he failed to conciliate the others, he proved sufficiently by his attitude that it was not

entirely his fault., Finally it was he who sanctioned the endeavors of ST. FRANCIS and ST. DOMINIC in spite of their revolutionary nature, in spite of the evident dangers which lurked in them. Thus the final triumph of the Gray and Black Friars must be credited at least in part to the spirit of toleration and the practical wisdom of INNOCENT III.

The psychological interest of this study is very great and historians of science, dealing with this period—one of the main turning points in the intellectual evolution of the West—ought to have some knowledge of it. It is partly for this reason that I have devoted so much space to a work which is more directly concerned with the development of religion than with the growth of understanding.

The author of this book was born of New England ancestry in Louisville, Kentucky, in 1864; she graduated from Wellesley in 1887, and while teaching in various schools obtained her M. A. in Western Reserve and her Ph. D. at Columbia (1907). The main part of the present volume is an expansion and revision of her doctor's thesis. She held many responsible positions in Bradford Academy, Barnard, Bryn Mawr and other schools; in the fall of 1918 she became principal of the Co-operative Open Air (Shady Hill) School in Cambridge, Massachusetts, but was obliged by an acute illness to relinquish her work. She died at Portland, Maine, on Sept. 20, 1921. The reviewer had the privilege of seeing her in Cambridge, and also in Pemaquid Point, Maine, and will ever keep of these few meetings the most pleasant remembrance. Miss DAVISON was not only an unusually good scholar, but a brave and noble woman who enriched her friends by her very presence.

The publication of this posthumous book would have been impossible but for the devoted collaboration of many friends, chiefly : Miss GERTRUDE R. B. RICHARDS who acted as editor and added many valuable notes of her own, Professor JAMES T. SHOTWELL who wrote a preface, and above all the author's sister, Mrs. WILLIAM R. BELKNAP of Louisville. The author's portrait published in frontispiece is an excellent likeness.

GEORGE SARTON.

J. D. Eisenstein. *Ozar Massaoth*, a collection of itineraries by Jewish travellers to Palestine, Syria, Egypt and other countries... with maps, notes and index. Selected and edited by J. D. EISENSTEIN, New York (Vol. I, Hebrew Text, privately published), pp. 352, 1926.

Mr. EISENSTEIN, the well-known author, and the editor of the Hebrew encyclopedia, *Ozar Israel*, has enriched Hebrew literature with a new compilation on the itineraries of Jewish travellers to various countries.

In the general introduction, the compiler hints at the travellers in Talmudic times, and gives a short sketch of their activity during the Geonic period. Brief mention is also made of the reports of the Christian

pilgrims during these two eras. Not all the itineraries of the Jewish travellers, quoted in the general introduction, are published in the book, the compiler selecting for publication the texts of such travels only as were of more literary and historical value. All in all there are twenty-four accounts of travels in the book. They are :

1. Travels of Rabbi BENJAMIN OF TUDELA . . . 1165-1173.
2. Itinerary of Rabbi PETHACHIA OF RATISBON . . . 1175-1185.
3. Travels of Rabbi JACOB BEN NATHANIEL HA-COHEN 12th Cent.
4. Travels in Palestine by Rabbi SAMUEL BEN SAMSON 1210.
5. Travels of Rabbi JACOB, messenger of R. JEHIEL of Paris 1238-1244.
6. The Routes of Jerusalem by Rabbi ISAAC HELO. 1333.
7. Letter of Travels by Rabbi ISAAC IBN ALFARA. 1441.
8. Letter of Travel by Rabbi ELIJA OF FERRARA. 1435.
9. Three Letters of Travels by Rabbi OBADIAH OF BERTINORO 1487-1488.
10. Letter of Travel by Rabbi MESHULAM BEN MENACHEM 1481-1483.
11. Letter of Travels by Anonymous Venetian Scholar 1495.
12. Travels in Palestine by Anonymous writer . . . 1522-3.
13. Travels of DAVID REUBENU of the Ten Tribes. 1522-5.
14. Travels of Rabbi ELIJAH OF PESARO 1622.
15. Travels of Rabbi ISAIAH HURWITZ (SHELAI). 1622.
16. Letters of Travels by Rabbi GERSON BEN ELIEZAR 1624-5.
17. Letters of Travels by the Karaite SAMUEL BEN DAVID 1641-2.
18. Letters of Travels by the Karaite MOSES YERUSHALMI 1654-5.
19. Letters of Travels by the Karaite BENJAMIN BEN ELIJAH 1785-6.
20. Diary of Travels by HAYYIM JOSEPH DAVID AZULAI 1753-8.
21. Stories of Travel in Galilee by SIMHAI BEN JOSHUA 1774.
22. Travels in Morocco by SAMUEL ROMANELLI . . 1786-90.
23. Letters of Travels by Dr. LAZARUS LOEWE . . . 1837.
24. Diary of Travels by Lady JUDITH MONTEFIORS. 1838-9.

A special introduction precedes the text of each traveller, giving his biography, an account of his journey, and an evaluation of the historical

importance and literary merit of his composition. The annotations consist of critical remarks, textual emendations, identifications of proper names and places, and explanations of some Arabic, Latin or Italian words, etc., which are here and there employed by the traveller.

The reviewer made no attempt to go over the editor's notes systematically, but, while perusing the book, some assertions seemed to him either doubtful or erroneous. Thus *Mista'arhim* (p. 131) is not Moriscos, but persons attempting to adopt the customs of the Arabs. The word is the Arabic *Musta'ribun*, in Hebrew garb. The emendation « *bint* » for *hgtu* (p. 134) is very doubtful. Besides, « *bint* » means in Arabic « girl », and not « girls. » The word *hol* (Job 29, 18) is identified by some commentators as the phoenix, not Venus ! (p. 258).

Here and there the editor has allowed himself to omit some passages or words (cf. p. 140, p. 171, p. 248 etc.) apologizing for their omission on the ground that they were undeserving of the attention of the reader. Likewise, a drawing in the book of SIMHAH BEN JOSHUA is also not reproduced by the compiler, on the claim that it would only perplex the reader (p. 249).

It may be said in general that the editor was too eager to emend the text. Reserved judgment, however, is always to be preferred to an arbitrary emendation.

Notwithstanding some inherent defects in the book, it must be owned that Mr. EISENSTEIN has performed a signal service to Hebrew students and those interested in medieval travel. Many of the texts being extant in rare editions only, the reader is now afforded the unusual opportunity of utilizing so many accounts at once, which heretofore had been even singly inaccessible to him.

(New York).

JOSHUA FINKEL.

André Metz. — *Une nouvelle philosophie des sciences — le causalisme de M. EMILE MEYERSON*. VI + 211 p. Paris. ALCAN 1928. (Fr. 15).

Ce livre court, agréable à lire, contient un excellent exposé de la doctrine de M. EMILE MEYERSON, dont les importants travaux d'épistémologie devraient être lus et médités par tous ceux qui s'intéressent à la psychologie de l'esprit scientifique, à l'histoire des sciences, ou au grave problème de la valeur de la connaissance. — M. ANDRÉ METZ, ancien élève de l'École polytechnique, déjà bien connu par ses remarquables écrits sur la théorie de M. EINSTEIN, ayant eu l'occasion de lire des fragments de *Déduction relativiste* devint rapidement un fervent disciple de M. MEYERSON, prit connaissance de l'œuvre entière, et se proposa de répandre les thèses maîtresses de l'auteur bien au delà du public extrêmement restreint, jouissant déjà d'une grande culture philosophique, en vue duquel cette œuvre a été écrite.

M. METZ s'est surtout efforcé de présenter l'essentiel des idées de M. MEYERSON, sous une forme accessible au grand public, et particulièrement au public scientifique, si fortement intéressé par des tentatives de ce genre; il serait heureux, dit-il, si le livre qu'il publie pouvait être considéré comme *une première introduction à l'œuvre de M. ÉMILE MEYERSON*. Disons tout de suite qu'il a parfaitement réussi dans son entreprise; désormais le travailleur de laboratoire, celui même qui fait profession de dédaigner la philosophie ou de mépriser la métaphysique se rendra compte sans effort, que le positivisme dérivé d'AUGUSTE COMTE qui s'étale encore bien souvent dans les préfaces de divers ouvrages scientifiques, a été vigoureusement attaqué, et victorieusement battu en brèche par les critiques auxquelles M. MEYERSON a soumis ses affirmations fondamentales, notamment la prétention de se passer désormais de la recherche des causes. Et ces critiques reproduites aujourd'hui par M. METZ avec beaucoup de conviction et de force persuasive doivent d'autant plus faire réfléchir, qu'elles n'ont encore, il faut le remarquer, suscité jusqu'à présent aucune réponse sérieuse des savants qui se réclament du positivisme, que ces savants soient par ailleurs spiritualistes, matérialistes ou pragmatistes.

Nous ne pouvons ici suivre le limpide exposé de M. METZ que les travailleurs qui n'ont pas encore lu *Identité et réalité* (*Isis* 9, 470-72), *De l'explication dans les sciences* (*Isis* 4, 382-85), ou *La déduction relativiste* (*Isis* 7, 517-20), auraient intérêt à connaître, soit pour avoir une idée de la philosophie scientifique de M. MEYERSON, soit pour parvenir, ainsi préparés, à aborder l'œuvre elle-même sans rencontrer trop de difficultés.

Paris.

HÉLÈNE METZGER.

Twenty Third Critical Bibliography

of the

History and Philosophy of Science and of the History of Civilization

(to October 1927)

This Twenty Third Bibliography contains about 790 items, some of which have been kindly contributed by the following scholars :

R. C. ARCHIBALD (Providence, R.I.)	C. D. LEAKE (Madison, Wisc.)
H. G. BÉVENOT (Weingarten, Würt.)	L. LEROUX (Paris)
R. P. BLAKE (Cambridge, Mass.)	E. O. VON LIPPMANN (Halle)
T. L. DAVIS (Cambridge, Mass.)	D.B.MACDONALD (Hartford, Conn.)
C.W. DODGE (Cambridge, Mass.)	H. METZGER (Paris)
L. GUINET (Brussels)	M. MEYERHOF (Cairo)
E. J. HOLMYARD (Bristol)	J. STEPHENSON (Edinburgh)
J.W.S. JOHNSON (Copenhagen)	H. WIELEITNER (Munich).

An authors' index will be found at the end. For general information on this undertaking see the Prefaces to the Sixteenth and Eighteenth Bibliographies in *Isis* VII, 172-174, 1925; VIII, 526-528, 1926.

Papers and books sent to the Editor are entered into this bibliography if they are relevant to its purpose. They may be the object of analytical notes or longer reviews, if this seems sufficiently necessary and the services of competent scholars are available. It is obvious that only a small number of publications can be adequately reviewed and that it is not even possible to give a brief description of each and every one. However, our classification is so comprehensive and so minute, that even if we do nothing but give the accurate title of an item and put it in its proper place, we are already rendering a real service to the author, the publisher and the learned public. It should also be noted that there is no relation between the importance of a publication and the length of the note devoted to it.

The ultimate aims of this undertaking are : 1) to establish the History of Science as an independent discipline; (2) to demonstrate inductively the Unity of Knowledge and the Unity of Mankind; (3) to serve as a center of information and rallying ground to the scholars engaged in our studies. We can not succeed entirely without their assistance, and they can help us in many ways. To serve them, as well as we can, is both

our duty and our pleasure. Critical work must be approached in a spirit of service or left untouched.

Harvard Library, Room 185.

Cambridge, Massachusetts.

GEORGE SARTON.

Dec. 9, 1927.

PART I.

FUNDAMENTAL CLASSIFICATION (CENTURIAL).

IXth Century B. C.

Bickel, Ernst. Homerischer Seelenglaube. Geschichtliche Grundzüge menschlicher Seelenvorstellungen. (*Schrift. d. Königsb. Gelehrt. Ges., Geisteswiss. Kl.*). p. 211-343. Berlin, Dtsche Verlagsges. für Politik und Gesch., 1925 ISIS

Reviewed by KURT LATTE in *Deutsche Literaturzeitung*, 956-958, 1927.

(**Homer**). *Introduction I*, 53. SCHLIEMANN, nicht DÖRPFELD, ist der Entdecker Troja's. *I*, 55. Es fehlen die deutschen Übersetzungen (seit Voss), die weitaus die besten sind. E. O. v. L. ISIS

Mülder, Dietrich. Bericht über die Literatur zu HOMER (höhere Kritik) aus den Jahren 1920-1924. *Jahresber. über die Fortschritte d. klassischen Altertumsw.*, 207, 1-90, 171-255, 1926. ISIS

VIIIth Century B. C.

Maximova, (Mlle.) M. I. Les vases plastiques dans l'antiquité (époque archaïque). Préface par E. POTTIER. Traduction par MICHEL CARROW. Tome I : Texte, 223 p.; Tome 2 : planches. Paris, P. GEUTHNER, 1927. (160 frs.) ISIS

Ceci est la première étude d'ensemble de ces vases curieux qui constituent une sorte de transition entre la figurine de terre cuite et le vase d'argile peinte. Elle est limitée à la période archaïque (VII^e et VI^e siècles) comprenant les productions ionienne, corinthienne, proto-corinthienne, héotienne, et constituant un ensemble parfaitement homogène. Le principal intérêt de cette belle monographie pour l'historien de la science et de la civilisation c'est de prouver une fois de plus l'importance de l'Ionie, qui fut sous beaucoup de rapports l'héritière de la Crète et devint le foyer où convergèrent les influences égyptiennes et orientales. " De toutes les fabriques de la Grèce archaïque, celles de l'Ionie sont incontestablement les plus intéressantes. Le rôle de l'Ionie a été prépondérant dans l'art hellénique au VII^e siècle et pendant une

partie du vi^e siècle. C'est en Ionie qu'a pris naissance l'art hellénique qui devait par la suite atteindre un si haut degré de développement. L'art ionien des vii^e et vi^e siècles est le printemps de l'art grec, le premier éveil de l'esprit créateur purement hellénique, inconscient de sa personnalité encore, et lié aux formules millénaires de l'Orient, mais ayant déjà l'intuition de sa force, de ses buts et de ses aspirations. » G. S.

Vith Century B. C.

Hsu, C. Y. The philosophy of CONFUCIUS. With a foreword by J. PERCY BRUCE. 63 p. London, Student Christian Movement, 1926.

ISIS

Karlgren, Bernhard. On the authenticity and nature of the Tso chuan. (*Göteborgs Högskolas Årsskr.* 32, 1926, 3). 65 p. Göteborg, WETTERGREN and KERBERS, 1926.

ISIS

Elaborate review by O. FRANKF, *Deutsche Literaturzeitung*, 1498-1507, 1927.

Thomas, Edward Joseph. The life of BUDDHA as legend and history. XXIV + 297 p., 4 pl., and map. (History of Civilization Series). London, KEGAN PAUL, 1927.

ISIS

Vth Century B. C.

Brown, Barnum. Is this the earliest known fossil collected by man ? *Natural History*, 26, 537-544, 1926.

ISIS

Apropos of a milk molar of *Elephas antiquus* found in the Asclepion of Cos. G. S.

Cambridge ancient history, the. Edited by J. B. BURY and others. Volume V., Athens. XXII + 554 p. Cambridge, University Press, 1927.

ISIS

Reviewed by DAVID M. ROBINSON, *American Historical Review*, 33, 93-95, 1927.

(Chinese lexicography). *Introduction I*, 110. BRETSCHNEIDER, und auch HIRT, liessen sich durch die planmässigen Fälschungen der chinesischen Autoren oft und weitgehend täuschen. E. O. v. L. ISIS

Heiberg, J. L. Alporismen om HIPPOCRATES. Studier fra Sprog- og Oldtidsforskning, No. 7. Copenhagen 1892. J. W. S. J. ISIS

Heiberg, J. L. Det hellige Syvtal. Festkrift til C. JUEL. *Matematisk Tidsskrift*, 1925. J. W. S. J. ISIS

(Herodotos). Das Geschichtswerk des HERODOT. Neu übertr. von THEODOR BRAUN. 810 p. Leipzig, Insel-Verlag, 1927. ISIS

Reviewed by F. JACORY, *Deutsche Literaturzeitung*, 1853-57, 1927.

- (**Hippocrates**). Indices librorum. Iusiurandum. Lex. De arte. De medico. De decen^{te} habitu. Praeceptiones. De prisca medicina. De aere locis aquis. De alimento. De liquidorum usu. De flatibus. Edidit J. L. HEIBERG. (*Corpus medicorum graecorum*, I, 1.) XII + 146 p. Leipzig, TEUBNER, 1927. ISIS

Index verborum, p. 102-146.

G. S.

- (**Hippokrates**). Eine Auslese seiner Gedanken über den gesunden und kranken Menschen und über die Heilkunst. Sinngemäß verdeutscht und gemeinverständlich erläutert von ARNOLD SACK. VI + 87 p., portrait. Berlin, SPRINGER, 1927. ISIS

- Jones, W. H. S.** 'The doctor's oath : an essay in the history of medicine. 62 p., 2 facsimiles. Cambridge, University Press, 1924. ISIS

Scholarly analysis of the so-called « Oath of HIPPOCRATES » based upon an examination of all available codices. Facsimile and translation of the Christian variant of the Oath, Urbinas 64, fol. 116, the oldest extant version, dating from the xth or x1th century. The perplexing « operating clause » is not found in this Christian version. « May it not be assumed that it did not belong to the original form, but was afterwards added to suit the prejudices of physicians at a certain period ? » No index. C. D. L.

- Klages, Ludwig.** Das Problem des SOKRATES. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 103-111, 1927. ISIS

- (**Scylax**). *Introduction I*, 104. Der Periplus ist zweifellos unächt. ISIS
E. O. v. L.

- Spiegelberg, Wilhelm.** 'The credibility of HERODOTUS' account of Egypt in the light of the Egyptian monuments. Being a lecture delivered at the fifty-fifth Congress of German Philologists and Schoolmasters at Erlangen. With a few additional notes by the translator, AYLWARD M. BLACKMAN. IV + 40 p., 2 pl. Oxford, BLACKWELL, 1927. ISIS

- Unger, F. C.** De groote HIPPOKRATES-uitgevers en de geschiedenis der geneeskunde. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 343-355, 1927. ISIS

- Walters, Henry Beauchamp.** A statuette of SOCRATES. *The British Museum Quarterly*, 1, 9-11, 1 plate, 1926. ISIS

A charming statuette acquired by the British Museum in 1925, Parian marble, 27.5 cm. high in its present condition (feet missing). It must be regarded as the earliest representation of the philosopher, dating from about the end of the fourth century B.C. It is a great work of art. G. S.

Wellmann, Max., HIPPOKRATES, des Thessalos Sohn. *Hermes*, 61, 329-334, 1926. ISIS

IVth Century B. C. (whole and first half).

(**Aeneas Tacticos**). AENEAS on siegecraft. A critical edition, prepared by LESLIE WHITAKER HUNTER. Revised, with some additions, by S. A. HANDFORD. Oxford, Clarendon Press, 1927. ISIS

Rivaud, Albert. PLATON auteur dramatique. *Rev. d'hist. de la philosophie*, 1, 125-151, 1927. ISIS

L'auteur pense que PLATON a cherché à faire de ses dialogues « une comédie, un drame d'idées » dans lesquels « il a voulu nous donner une impression plutôt que des leçons positives ». « Les éléments dogmatiques du platonisme n'étaient peut-être que des éléments techniques » tandis que les dialogues « contiennent sans doute moins un enseignement qu'une annonce, un programme, un manifeste en faveur de l'école platonicienne »; ils n'exposent donc pas un système, et leur objet primitif est, non pas dogmatique, mais historique. L. G.

IVth Century B. C. (second half).

(**Aristotle**). *Introduction I*, 128, 132. *Μ.χανικα* und *iv Meteorologica* sind zweifellos unächt. E. O. v. L. ISIS

(**Aristotle**). The works of ARISTOTLE translated into English under the editorship of W. D. ROSS. Volume VII. *Problemata*, by E. S. FORSTER. New York, Oxford University Press, American Branch, 1927. ISIS

We have already spoken (see *Isis*, 6, 138; 7, 532) of this English translation of ARISTOTLE, to be completed in eleven volumes, corresponding in content and pagination with the BEKKER's 8vo Oxford edition; Vol. VII contains the *Problemata*. Says the translator: 'The inclusion of the *Problemata* in the Aristotelian Corpus is no doubt due to the fact that Aristotle is known to have written a work of this kind, to which reference is made in his genuine works and by other writers. An examination of these references shows that some of them can be connected with passages in the *Problemata*, while others cannot; from which it may be concluded that, while the *Problemata* is not the genuine Aristotelian work, it nevertheless contains an element derived from such a work. It is also obviously indebted to other Aristotelian treatises, especially those on Natural History, to the Hippocratean writings, and to THEOPHRASTUS. The repetitions and contradictions which occur in the work seem to show it was a gradual compilation by several hands; and, if one may judge from the late forms of words which occur in several passages, it did not reach its final form until some time after the beginning of the Christian Era. Some critics would date its completion as late as the fifth or sixth century A. D. The doctrine throughout is Peripatetic, and the variety of subjects treated shows the wide interests of that school. The text used for this translation is that of Ruelle-Knoellinger-Klek (Leipzig, Teubner, 1922) "There

is an excellent index which is especially useful for a miscellaneous collection of this kind. G. S.

Arnim, Hans von. Die drei aristotelischen Ethiken. 142 p. *Wiener Akademie, Phil. Kl. Sitzungsber.*, 202, 2, 1924. ISIS

Reviewed by J. L. STOCKS in *Deutsche Literaturzeitung*, 1054-1059, 1927.

Arnim, Hans von. Zur Entstehungsgeschichte der aristotelischen Politik. *Akad. d. Wiss. in Wien, Philos-histor. Kl., Sitzungsber.*, 202, 1. 130 p. Wien, Hölder-Pichler-Tempsky, 1924. ISIS

Reviewed by J. L. STOCKS in *Deutsche Literaturzeitung*, 1054-1059, 1927.

Atanassiévitch, Xénia. L'atomisme d'EPICURE. 111 p. Paris, Les Presses universitaires de France, 1927. ISIS

Haberling, Wilhelm. Der glatte Hai des ARISTOTELES. Briefe JOHANNES MÜLLERS über seine Wiederauffindung an WILHELM KARL HARTWIG PETERS 1839-1840. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 166-184, 5 Abb., 1927. SIS

Joachim, Harold H. ARISTOTLE'S Conception of Chemical Combination. *The Journal of Philology*, 29, 71-86, 1903. ISIS

A very valuable study of ARISTOTLE'S conception of $\kappa\rho\acute{\alpha}\sigma\iota\varsigma$ or $\mu\acute{\iota}\xi\iota\varsigma$. ARISTOTLE recognizes the distinction between mechanical mixture and chemical combination. The proper term for the first is $\sigma\acute{\upsilon}\nu\theta\epsilon\sigma\iota\varsigma$, though sometimes it is popularly called $\mu\acute{\iota}\xi\iota\varsigma$. The proper term for chemical combination in general is $\mu\acute{\iota}\xi\iota\varsigma$: for chemical combination of liquids the strict term is $\kappa\rho\acute{\alpha}\sigma\iota\varsigma$. If two or more bodies are put together without alteration, this is a $\sigma\acute{\upsilon}\nu\theta\epsilon\sigma\iota\varsigma$, and the resultant is a mechanical mixture. A $\mu\iota\chi\theta\acute{\epsilon}\nu$, or chemical compound, is such that (1) its components have really merged into a unity, instead of forming a mere aggregate by juxtaposition: and that (2) the components although contained in the resultant, are contained there in an altered form. The facts are drawn mainly from *de generatione et corruptione* and ZABARELLA and ALEXANDER'S works. (ALEXANDER, *Περὶ κράσεως καὶ ἀνέξεως* ed. BRUNS, and ZABARELLA, *de mistione*, ch. 13, etc., Cologne edition of 1594.) E. J. H.

(Kauṭilya). *Introduction I*, 147. Die Arthaśāstra ist vielfach, und bis in späte Zeit hinein, interpoliert. E. O. v. L. ISIS

Steensby, Hans Peder. PYTHEAS fra Massilia og Jyllands Vestkyst. *Geografisk Tidsskrift*, Bind 24, 1917. J. W. S. J. ISIS

(Theophrastos). *Introduction I*, 186. Wasserbad (bain Marie) wird schon bei THEOPHRASTOS als bekannt erwähnt. E. O. v. L.

ISIS

Wright, Jonathan. The evolution of the thought of ARISTOTLE. I. The

Platonic SOCRATES and the Platonic ARISTOTLE. *Annals of Medical History*, 9, 144-168, 1927. ISIS

IIIrd Century B. C. (whole and first half).

Fladt, Kuno. EUCLID. VIII + 72 p., 10 fig. Berlin, OTTO SALLE, 1927. ISIS

Heath, Sir Thomas L. The thirteen books of EUCLID's Elements. Translated from the text of HEIBERG, with introduction and commentary. Second edition. 3 vols. Cambridge, University Press, 1926. ISIS

Reviewed by HEINRICH WIELEITNER in *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 238-240, 1297; and by GEORGE A. GIBSON, *Nature*, 119, 152-3, 1927. The first edition appeared in 1908.

(Museum). *Introduction I*, 158, 466. Bibliotheken Alexandria's dürfen grössentheils schon bei der Belagerung durch J. CAESAR zerstört worden sein. E. O. v. L. ISIS

(Proverbs of Solomon). *Introduction I*, 163. Sprichwörter SALOMO's stammen zum grossen Teil aus altägyptischen Quellen. E. O. v. L. ISIS

Samaritan Pentateuch (*Introduction I*, 151). Concerning the Samaritans there is a good article in *Bibliotheca Sacra* (St. Louis), Jan. 1921, 1-22, and recent publications by MOSES GASTER: The Samaritans (Oxford press, 1925); Encyclopaedia of Islam (vol. 4, 124-29, 1925, and supplement of 15 p., 1925). He thinks it much older than most scholars do. H. G. BÉVENOT. ISIS

IIIrd Century B. C. (second half).

Czwalina, Arthur. Berechnung von Quadratwurzeln bei den Griechen *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 334-335, 1 Abb., 1927. ISIS

Apropos of ARCHIMEDES's approximate value of the square root of three. G. S.

Kliem, Fritz, und Wolff, Georg. ARCHIMEDES. VIII + 143 p., 64 fig., 3 pl. Berlin, OTTO SALLE, 1927. ISIS

Kliem, Fritz. APPOLLONIUS. 75 p., 39 fig. Berlin, OTTO SALLE, 1927. (Mk. 2.40). ISIS

This little book is divided as follows: 1. APOLLONIUS' Leben und Schriften; 2. Die Berührungsaufgabe; 3. Die Kegelschnitte. It contains a clear analysis

of the eight books of APOLLONIUS's Conics, in modern language. It will enable the reader to obtain with comparative ease a good appreciation of the method and contents of this great work. G. S.

Paoli, Humberto J. M. « Spamnites » (sic) di ARCHIMEDES da Surakusai, con appendici di HEARTH (sic) e CHASLES. 92 p., 32 fig., casa edit. « Coni », Buenos Aires, 1925. ISIS

Cette traduction espagnole de l'Arénaire ($\psi\alpha\mu\mu\acute{\iota}\tau\eta\varsigma$) se présente fort mal, avec les trois fautes d'orthographe que présente son titre [le ψ transformé en sp., (la faute est cependant corrigée à la main sur l'exemplaire que j'ai reçu), le $\mu\mu$ en mn, et le nom de T. L. HEATH modifié en Hearth]. Page 5, un portrait ? d'ARCHIMÈDE, avec cette indication « nato il 212 a. C., morto il 137), où l'âge d'ARCHIMÈDE est bien respecté, mais l'année de sa mort étant prise pour celle de sa naissance, et 137 n'ayant aucun rapport avec le géomètre de Syracuse; à la même page 5, on cite Hultse pour HULTSCH, Kyöbenhavn est imprimé comme un nom d'homme; p. 6 « il papiro fu trovato dall'HEIBERG nel 1917 », il s'agit du palimpseste découvert à Jérusalem en 1899, déchiffré en 1906 par J. L. HEIBERG, et traduit en allemand, avec commentaire de H. G. ZEUTHEN en 1907 ! etc... Comme celle de VER ECKE (*Isis*, 4, 499-501), la traduction est littérale, mais partagée en chapitres avec titres, sous titres, numéros de paragraphes. Nombreuses notes donnant un commentaire en notations modernes : on les dirait presque reprises de l'édition de VER ECKE. L. G.

IND CENTURY B. C. (whole and first half).

Wunderer, Carl (d. 1926). POLYBIOS : Lebens- und Weltanschauung aus dem zweiten vorschristlichen Jahrhundert. (*Das Erbe der Alien*, Heft, 12). VIII + 79 p., pl. Leipzig, DIETERICH, 1927. ISIS

Reviewed by JACOB HAMMER, *American Historical Review*, 33, 171-2, 1927.

1st Century B. C. (whole and first half).

Cleomedes. Die Kreisbewegung der Gestirne. Übersetzt und erläutert von ARTHUR CZWALINA. (*Ostwalds Klassiker*, 220). IV + 93 p. Leipzig, Akademische Verlagsgesellschaft, 1927. ISIS

(**Lucretius**). *Introduction I*, 205. Es fehlt die beste Ausgabe und Übersetzung, von DIELS (Berlin, 1922, 23). E. O. v. L. ISIS

(**Theodosius Tripolites**). *Sphaerica*. Edidit J. L. HEIBERG. (*Abhandlungen der Gesellschaft der Wissenschaften zu Göttingen. Philologisch-historische Klasse*, neue Folge, Bd. 19, 3). XIV + 199 p. Berlin, WEIDMANN, 1927. ISIS

In my note on THEODOSIUS of Bithynia (*Introduction*, vol. I, 211) I stated that a critical edition of his works was very much needed. I did not realize when writing this that my wish would be so promptly satisfied. For here

we have a critical edition of THEODOSIOS's main work, the Spherics, by one of the leading scholars on the subject. The Greek text is accompanied by a Latin translation and followed by Greek scholia. No glossary. G. S.

Ist Century B. C. (second half).

Mondolfo, Rodolfo. La formazione storica delle arti e dello spirito umano in VITRUVIO. *l'Arduo*, 2, 153-9, 1922. ISIS

Ist Century (whole and first half).

(Celsus). *Introduction I*, 240. Er übersetzte das Buch des kaiserlichen Hofarztes MENEKRATES (WELLMANN). E. O. v. L. ISIS

Couchoud, Paul Louis. Les textes relatifs à JÉSUS dans la version slave de JOSÈPHE. *R. de l'hist. des religions*, 93, 44-64, 1926. ISIS

Publication et commentaires de huit passages concernant JEAN-BAPTISTE et JÉSUS, qui se trouvent dans la traduction en vieux russe de la Guerre des Juifs, de FLAVIUS JOSÈPHE, et qui ne figurent pas dans le texte grec de cet ouvrage. Ces passages sont traduits d'après A. BERENDS (1906) qui suit principalement le Codex 651 de l'Académie de Moscou. Pour l'auteur, ces textes ne peuvent être attribués à JOSÈPHE. L. G.

(Democritos, pseudo). *Introduction I*, 239. Die « syrischen Texte » sind höchst verdächtig und aus später Zeit. E. O. v. L. ISIS

Eisler, Robert. JÉSUS d'après la version slave de FLAVIUS JOSEPH. *R. de l'hist. des religions*, 93, 1-21, 1926. ISIS

Voir ci-dessus la notice relative au travail de P. L. COUCHOUD. Contrairement à COUCHOUD, EISLER invoque en faveur des fragments slaves de JOSÈPHE la lumière dont ils seraient susceptibles d'éclairer certains textes évangéliques. L. G.

Gardner-Smith, Percival. The narratives of the resurrection; a critical study. XXVII + 196 p. London, METHUEN, 1926. ISIS

Goguel, Maurice. Le témoignage de la version slave de la « Guerre juive » de JOSÈPHE sur la mort et la résurrection de Jésus. *R. de l'hist. des religions*, 93, 22-43, 1926. ISIS

Voir ci-dessus : COUCHOUD, EISLER. « Il n'est pas possible, dit GOGUEL, que les fragments propres à la version slave de la guerre juive puissent jeter quelque lumière nouvelle sur les textes évangéliques et aider à les interpréter. » Bibliographie. L. G.

K., W. Glass figure of a whale from Greece. *The British Museum Quarterly*, 1, 104-106, 1 pl., 1927. ISIS

Curious figure of blown glass measuring 7 inches and representing imperfectly a bottle-nosed whale; according to a note contributed by Sir SIDNEY

HARMER, the *Ziphius cavirostris* described by CUVIER in 1823. « It may be ascribed to the first century » of our era. G. S.

1st Century (second half).

(Dioscorides). *Introduction I*, 259. *περί ἀπλῶν φαρμάκων* ist nicht apokryph, s. Zeile 34. Das berühmte Manuscript ist in Wien. E.O.v.L. ISIS

Fischer, Isidor. Die Gynäkologie bei DIOSKURIDES und PLINIUS. 36 p. Wien, SPRINGER, 1927. ISIS

Henderson, Bernard William. Five Roman emperors, A. D. 69 — 117. Cambridge, University Press, 1927. ISIS

McNeile, Alan Hugh. An introduction to the study of the New Testament. Oxford, University Press, 1927. ISIS

Mothersole, Jessie. AGRICOLA's road into Scotland : the great Roman road from York to the Tweed. With illustrations in colour and black and white by the author. Plates, plans, maps and diagrams. London, JOHN LANE, 1927. ISIS

(Nero). *Introduction I*, 247. NERO's « Smaragd » war keine Linse, sondern ein grünes Glas zum Schutze seiner schwachen Augen; auch eine grüne Arznei heisst « smaragdinus ». E. O. v. L. ISIS

Scott, Charles A. Anderson. Christianity according to ST. PAUL. XIV + 284 p. Cambridge, University Press, 1927. ISIS

« It is a strange fate indeed which has befallen the Apostle PAUL in the last quarter of a century. For four centuries at least he has been looked on as the champion of an Evangelical interpretation of Christianity, his writings as the sheet-anchor of Protestantism. Now there is an influential school of thought both at home and abroad which claims him as the author of « sacramentarian » Christianity and the only begetter of Catholicism.

This book has been written with the issue thus raised in view, but with the conviction that the best way of dealing with it is to set forth as fully as may be within the necessary limitations of space what chiefly matters in St PAUL's conception of Christianity. Some of the results, which have been slowly arrived at through many years of study of the Apostle, are not likely to please partisans either of traditional Protestantism or of traditional Catholicism. »

• IInd Century (whole and first half).

Czwalina, Arthur. Die Trigonometrie des PTOLEMÄUS von Alexandria. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 241-249, 1927. ISIS

- Luckey, P.** Das Analemma von PTOLEMÄUS. *Astron. Nachr.* 230, 18-46, 1927, mit 1 Tfl. ISIS

Die Vermutung dass die mittelalterlichen Verfahren, die bei dem Gebrauch der Astrolabien üblich waren, auf das Altertum zurückgehen müssten, führte den Verf. auf das (leider nur in lat. Übersetzung erhaltene) Analemma des PTOLEMAIOS, das zwar schon von verschiedenen Männern und von verschiedenen Gesichtspunkten aus studiert worden war, über das eine alle Gesichtspunkte berücksichtigende, in den Sinn des Ganzen eindringende Untersuchung aber immer noch fehlte. Die vorliegende Arbeit füllt diese Lücke in jeder Hinsicht völlig aus. Der Verfasser bespricht nacheinander das Analemma als das graphische, das rechnerische und das nomographische Verfahren, das in ihm steckt. Dabei ist freilich das Rechnerische nur angedeutet, da die Ausführung für PTOLEMAIOS zu umständlich gewesen wäre. Auch darf man nicht glauben, dass etwa das Analemma ein modernes Nomogramm sei. Doch hat der Verf. durchaus recht, wenn er sagt, dass wir das alte Verfahren, ohne etwas hineinzulesen, als im Wesen mit den modernen Gesichtspunkten übereinstimmend betrachten dürfen. Die Untersuchung hat als Nebenresultat ergeben, dass PTOLEMAIOS in der Fassung der Begriffe und in der Verwendung der Methoden über seine Vorgänger hinaus wesentliche Fortschritte machte, und dass er sich der Verbesserungen, die er einführte wohl bewusst war. Auch in terminologischer Beziehung bringt die Arbeit LUCKEYS manches Neue. H. W.

- Malone, Kemp.** PTOLEMY's Skandia. *American Journal of Philology*, p. 362-370, 1924. ISIS

- Renou, Louis.** La géographie de PTOLEMÉE. L'Inde (VII, 1-4). *Thèse de doctorat*, 73 p., 6 cartes. Paris, CHAMPION, 1925. ISIS

Édition critique du texte et traduction française. Reproduction en fac-similé des trois cartes grecques du Venetus 516 (R) : Inde cisganguétique, Inde transganguétique, Taprobane, et transcription latine de ces cartes.

- (**Soranos**). SORANI Gynaeciorum libri IV, De signis fracturarum, De fascis, Vita HIPPOCRATIS secundum SORANUM, edidit JOANNES ILBERG. Adnexae sunt tabulae XVIII. (*Corpus medicorum graecorum*, IV). XXII + 282 p., 18 pl. Leipzig, TEUBNER, 1927. ISIS

The eighteen plates contain a large number of illustrations derived from the Codex Laurentianus LXXIV. 7. Very copious indices (nominum; verborum), p. 185-282. G. S.

- (**Theon of Smyrna**). *Introduction* I, 272. Magische Quadrate waren in Vorderasien schon lange bekannt. E. O. v. L. ISIS

IInd Century (second half).

- (**Aretaios**). *Introduction* I, 307. Diabetes ist bei ihm Polyurie, nicht Zuckerkrankheit. E. O. v. L. ISIS

- (**Pausanias**). *Introduction* I, 300. PAUSANIAS hat schwerlich selbst alles

bereist sondern Vieles aus älteren Büchern abgeschrieben. E.O.v.L. ISIS

IIIrd Century (whole and first half).

(Alexander of Aphrodisias). *Introduction I*, 319. Er weiss *nichts* über die wirkliche Destillation. E. O. v. L. ISIS

Miura-Stange, Anna. CELSUS und ORIGENES, das Gemeinsame ihrer Weltanschauung nach den acht Büchern des ORIGENES gegen CELSUS. VII + 166 p. Giessen, ALFRED TÖPELMANN, 1926. ISIS

Reviewed by U. v. WILAMOWITZ-MOELLENDORFF, *Deutsche Literaturzeitung*, 103-105, 1927.

Müller, Reiner. Die Geographie der Peutingerschen Tafel in der Rheinprovinz, in Holland und Belgien. S. A. aus *Geographischer Anzeiger*, 1926, 8 p. ISIS

(Silk trade routes). *Introduction I*, 315. Es fehlen HERRMANN's massgebende Arbeiten über Seidenstrassen etc. E. O. v. L. ISIS

IIIrd Century (second half).

(Caelius). *Introduction I*, 340. Wir besitzen nur einen Auszug, etwa aus dem 5. Jahrhundert n. Chr. E. O. v. L. ISIS

Caley, Earle Radcliffe. The Stockholm papyrus. An English translation with brief notes. *Journal of Chemical Education*, 4, 979-1002, 1927. ISIS

The first translation in English, based upon the Greek text and the German translation of LAGERCRANTZ. The Leiden papyrus X deals largely with metals, the Stockholm papyrus largely with the arts of dyeing, imitating precious stones, etc.; together they constitute our most valuable source of knowledge about the chemical arts of (probably) the latter part of the third century. Recipe No. 74 gives intelligible and practical directions for the preparation of verdigris. T. L. D.

Czwalina, Arthur. Ein falscher Satz des PAPPUS. *Mitteilungen zur Geschichte der Medizin und der Naturwissenschaften*, 26, 233-4, 1927. ISIS

Rome, (abbé) A. L'astrolabe et le météoroscope d'après le commentaire de PAPPUS sur le 5^e livre de l'Almageste. *Annales de la Société scientifique de Bruxelles, Série A. Sciences mathématiques*, 47, 77-102, 1 fig., 1927. ISIS

« Nous avons déjà parlé des cercles équatoriaux d'après THÉON, au 3^e livre de son commentaire sur l'Almageste. En faisant subir sa dernière toilette

au 5^e livre de PAREUS, nous avons rencontré des renseignements sur l'appareil le plus compliqué de l'observatoire antique : le météoroscope, et son frère un peu simplifié, l'astrolabe. » L'astrolabe dont il s'agit ici n'est pas l'astrolabe plan, mais l'« astrolabon organon », un groupe de sept anneaux (ou armilles) concentriques articulés l'un sur l'autre. G. S.

(Zosimos). *Introduction I*, 339. Dis Schrift über Bier ist eine Fälschung.
E. O. v. L. ISIS

IVth Century (whole and first half).

Burch, Vacher. *Myth and CONSTANTINE THE GREAT*. VIII + 321 p.
Oxford, University Press, 1927. ISIS

« A fresh examination of the legends which have gathered about CONSTANTINE has led to the discovery of a primal *Vita Constantini* as their source. This document was an early Romano-Sabine product. It displaces the Near East as the creator of the tales which gave the Constantine-Silvester literature such vogue in the Middle Age. »

(Eusebios). *The Ecclesiastical History and the Martyrs of Palestine*.
Translated with introduction and notes by HUGH JACKSON LAWLOR,
and JOHN EARNEST LEONARD OULTON. Vol. I : translation. XVI +
402 p. London, S. P. C. K., 1927. ISIS

IVth Century (second half).

Feldhaus, Franz M. *Technisches in den Dichtungen des CLAUDIUS CLAUDIANUS. Geschichtsblätter für Technik, Industrie und Gewerbe*,
II, 151, 1927. ISIS

Monceaux, Paul. *SAINT MARTIN, Récits de SULPICE-SÈVÈRE mis en français avec une introduction*. 242 p. Paris, PAYOT, 1926. ISIS

Plater, William Edward and White, H. J. *A grammar of the Vulgate*.
Oxford, Clarendon Press, 1926. ISIS

Vth Century (whole and first half).

Monneret de Villard, Ugo. *Les couvents près de Sohâg (Deyr el-Abiad et Deyr el-Ahmar)*. Ouvrage publié sous les auspices du Comité de Conservation des Monuments de l'Art Arabe. 2 vols., 222 pl.
Milan, 1926. • ISIS

Reviewed by A. KINGSLEY PORTER, *Speculum*, 2, 356-359, 1927. •

(Olympiodoros). *Introduction I*, 389. Der Alchemist und der Historiker sind nicht identisch.
E. O. v. L. ISIS

Tanfani, Gustavo. *La rieducazione dei movimenti nelle paralisi*

secondo CELIO AURELIANO. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle Scienze mediche e naturali (Venezia, 1925) Siena, p. 216-221, 1926. ISIS

Vth Century (second half).

Datta, Bibhutibhushan. « ĀRYABHATA, the author of the « Ganita » *Bulletin of the Calcutta Mathematical Society*, 18, 5-18, 1927. ISIS

The author of the « Ganita » is that ĀRYABHATA who was born in 476 and not a writer of the tenth century as KAYE has argued (« Notes on Indian mathematics, no. 2 — ĀRYABHATA », *Journal Asiat. Soc. Beng.*, p. 111, 1908; « The two ĀRYABHATAS », *Bibl. Mathematica*, 10, 289-292, 1910). R. C. A.

Gānguli, Sārādākānta. The elder ĀRYABHATA and the modern arithmetical notation. *American Mathematical Monthly*, 34, 409-15, 1927. ISIS

BURNELL asked « May not ĀRYABHATA be the discoverer of the decimal notation in India ? » The author answers yes. « Both ĀRYABHATA and BRAHMA GUPTA have omitted the easier topics from the chapters of their works dealing with mathematics. But while the enunciation of the modern arithmetical notation finds a place in the elder ĀRYABHATA's work, BRAHMA GUPTA considers it too common-place for inclusion in his work. ĀRYABHATA would have certainly omitted it on account of its simplicity if it were popular when the Āryabhatīyam was written or if it had occurred in a previous work. This leads us to conclude that the Āryabhatīyam is the first work in which the modern arithmetical notation has been explained. »

Vith Century (whole and first half).

Bereschit rabba, mit kritischem Apparat u. Kommentar von J. THEODOR. Nach dem Ableben des Verfassers bearbeitet und ergänzt von CH. ALBECK. Lief. 10-12, pp. 721-960. (*Veröffentl. d. Akad. für die Wissenschaft des Judentums*). Berlin, POPPELAUFR, 1926. ISIS

Reviewed by S. LANDAUFR in *Deutsche Literaturzeitung*, 1197-1198, 1927

Herwegen, Ildefons. (Abt von Maria Laach). Der heilige BENEDIKT. Ein Charakterbild. 3 Aufl. IX + 165 p. Düsseldorf, L. SCHWANN, 1926. ISIS

Reviewed by JOSEPH LORTZ in *Deutsche Literaturzeitung*, 1145-54, 1927

Schleifer, J. Zum Syrischen Medizinbuch. *Zeits. f. Semitistik und verwandte Gebiete*, 4, 70-122, 161-195, 1926. ISIS

BROCKELMANN pointed out that the Syriac medical treatise edited by WALLIS BUDGE was largely, in its general sections on pathology and therapeutics, taken from GALEN's *περὶ τῶν πεπονηότων τόπων*. The present author has found a further series of borrowings from GALEN, beyond those noticed

by BROCKELMANN. A suspicion was awakened that the rest of the general portion of the work might owe its origin to Greek writings, perhaps to other works of GALEN. This has proved to be the case; almost the whole of the general pathological-therapeutic portion is taken from various works of GALEN; these are enumerated, the several passages being equated with the parallel passages of the Syriac. The author has subjected BUDGE's translation to a revision, and the greater part of the present communications consist of suggested improvements in translation, of a number of emendations of the Syriac text based on a comparison of the Greek from which it was taken, and of explanations of the text. See SARTON's *Introduction*, vol. I, 310. J. S.

Tuffau, Paul. Le merveilleux voyage de SAINT BRANDAN à la recherche du Paradis. Légende latine du IX^e siècle renouvelée. 198 p. Paris, L'artisan du Livre, 1925. ISIS

A graceful literary development of the *Peregrinatio Sancti Brandani*, which offers some archaeological interest because it deals with one of those mythical Atlantic islands which have so much engrossed the minds of seafaring people not only during the Middle Ages but almost until modern times. (See WILLIAM H. BABCOCK : *Legendary islands of the Atlantic*, New York 1922; *Isis*, 5, 167-70). Some elements of the legend suggest comparison with the Arabian Nights, e.g. the moving island, which is the largest of all fishes, named Jasonius, and the gigantic bird which makes one think of Rukhkh ! BRANDAN (Brendan, Brenain) of Clonfert was an Irish saint (born in 484, died in 577). See Dictionary of national biography (vol. 6, 259) and Potthast (1896, 1221). G. S.

VIth Century (second half).

Gregory of Tours (538-594). History of the Franks. Translated with an introduction by ORMONDE MADDOCK DALTON. Two volumes. Oxford, Clarendon Press, 1927. ISIS

VIIth Century (whole and first half).

Bual, F. The Koran. Encyclopaedia of Islam, vol. 2, 1063-1076, 1927. ISIS

Moreau, Edouard de (S. J.). SAINT AMAND. Apôtre de la Belgique et du Nord de la France. (Museum Lessianum. Éditions et publicat. dirigées par des Pères de la Comp. de Jésus.) x + 367 p. Louvain, Museum Lessianum, 1927. ISIS

Reviewed by HÉLÈNE WIERUSZOWSKI, *Deutsche Literaturzeitung*, 1846-48, 1927.

(**Stephanos**). *Introduction I*, 473. Sein Buch ist nicht apokryph. E. O. v. L. ISIS

Temple, Sir R. C. To the East of Samatata (S. E. Bengal). *Indian Antiquary*, 55, 113-15, 1926. ISIS

Towards an identification of the countries mentioned (but not visited)
by the Chinese traveller HSÜAN TSANG. J. S.

VIIth Century (second half).

(**Callinicos**). *Introduction I*, 494. Salpeter war damals noch unbekannt,
vollends für Sprengstoffe und dergleichen. E. O. v. L. ISIS

(**Khâlid ibn Yazîd**). *Introduction I*, 489, 495. Die Angaben über
KHÂLID sind ganz unhaltbar. E. O. v. L. ISIS

VIIIth Century (whole and first half).

Colgrave, Bertram. The life of Bishop WILFRID by EDDIUS STEPHANUS.
Latin text, translation, and notes. xvii + 192 p. Cambridge, Univer-
sity Press, 1927. ISIS

« EDDIUS's Life of WILFRID (634-709) is, with the exception of the Anonymous Life of St CUTHBERT, and BEDE's Metrical Life of the same saint, the earliest piece of biography we possess. In fact it is almost the earliest considerable piece of literature written in this country. Its importance is obvious for it gives us a contemporary picture of a man who was a great figure in the political and ecclesiastical life of the seventh century. The Church was definitely moulded into shape during WILFRID's lifetime, and WILFRID himself played a leading part in deciding what that shape should be. He was largely instrumental in converting the whole of Northumbria to the Roman form of Christianity; he brought the north definitely into contact with the Mother Church by his journeys to Rome and by his appeals to the Apostolic See; he built churches which were the wonder of the western world; he exercised a great influence on the art and architecture of the times, and, more important even than all these, by his defiance of kings and princes he asserted the authority of the Church in so definite a manner that as a result no less than twenty six of the forty-six years of his episcopacy were spent in exile. He died worn out by the struggle, but he had triumphantly proved that the Church was no mere appendage to the throne. »

(**Heliodoros**). *Introduction I*, 514. THEODOSIOS III. hielt schon KOPF
für möglich. E. O. v. L. ISIS

VIIIth Century (second half).

(**Compositiones ad tingenda**). *Introduction I*, 533. Ein bronzenener
Mörser, bronzinus, wird schon um 700 im « Fragment von Ivrea »
erwähnt; von Vitriol sagt schon PLINIUS, er setze sich wie ein blaues
Glas an ; vergleiche das italienische « vetraviolo ». E. O. v. L.
ISIS

(**Jâbir ibn Haiyân**). *Introduction I*, 532. S-Hg-Theorie ist schon
alexandrinischen Ursprungs. E. O. v. L. ISIS

(**Mappae clavicula**). *Introduction I*, 534. Alkohol : die Angaben von DIELS und DEGERING sind völlig unhaltbar. E. O. v. L. ISIS

Simonini, R. Sopra un « Antidotarium Theodoron » contenuto in un Codice dell' VIII-IX secolo, conservato nell' Archivio Capitolare di Modena. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, p. 188-93, 1926. ISIS

Simonini, R. Sopra un codice dell' VIII secolo conservato nell' Archivio della Metropolitana di Modena e contenente APULEJ Liber De Ablatione simplicium (Comunicazione preventiva). Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, p. 178-187, 1926. ISIS

IXth Century (whole and first half).

Lowe, Lawrence F. H. and Edwards, Bateman. The language of the Strassburg oaths. *Speculum* 2, 310-317, 1927. ISIS

(**Muslim mineralogy**). *Introduction I*, 572. Das Steinbuch des ARISTOTELES ist nicht mit dem syrischen Buch von AHRENS identisch. E. O. v. L. ISIS

Rifā'i, Aḥmad Fārid. 'Aṣr AL-MA'MŪN. ('Time of AL-MA'MŪN) Vol. 1. large 8vo in Arabic. Cairo, Arabic Library Press, 1927. ISIS

A rather poor compilation. Chapter VIII : « scientific life in the time of AL-MA'MŪN » (pp. 375-398) is compiled from the works of SANTELLANA and GURGI ZAIḌĀN (Ta'rikh at-tamaddun al-islāmī) giving quotations from IBN AN-NADĪM, IBN AL-QIFTĪ, IBN ABĪ UṢĀIBĪ'A mostly in the form of anecdotic tales without order and plan. The list of translations is very incomplete. No references to the translations existing in libraries, not even those of Egypt. Chapter IX and X (literature and prominent scholars) have been examined by my friend Prof. JOS. SCHACHT of Freiburg and led him to the same judgment. M. M.

IXth Century (second half).

(**Dhū-l-Nūn**). *Introduction I*, 592. Die alchemistischen Schriften sind gefälscht. E. O. v. L. ISIS

(**al-Jāḥiz**). *Introduction I*, 579. Die Angabe über Salmiak ist fragwürdig (RUSKA). E. O. v. L. ISIS

Techert, Marguerite. Le plotinisme dans le système de JEAN SCOT ERIGÈNE. *Rev. néo-scholastique de philos.*, 27, 28-68, 1927. ISIS

- Wiedemann, Eilhard.** QOṢṬA IBN LÛQÂ AL-BA'ALBAKKÎ. *Encyclopaedia of Islam*, Vol. 2, 1081-83, 1927. ISIS
Elaborate study with bibliography. G. S.

Xth Century (whole and first half).

- Asín Palacios, Miguel.** Abenmassarra y su escuela. Orígenes de la filosofía Hispano-Musulmana (Discurso de ingreso en la Real Academia de Ciencias Morales y Políticas). Madrid, 1914. 167 pp. ISIS

IBN MASARRA of Cordova (883-931) was the founder of that Pseudo-Empe-
doclean or Illuministic philosophy which is best known through the works
of another Spaniard, IBN 'ARAFI (1165-1240). On the occasion of his admission
into the Spanish Academy, ASÍN presented his fellow members with this
very elaborate study, largely based upon the sources. He dealt successively
with : 1) Muslim thought during the first three centuries; 2) Hispano-Muslim
thought during the same period; 3) IBN MASARRA's life; 4) his pseudo-Empe-
doclean doctrine; 5) historical criticism of that doctrine; 6) his theological
views; 7) his influence. Our only regret is that so thorough a study should
have been left incomplete by the lack of an index. G. S.

- (**Ibn Waḥshiya**). *Introduction I*, 634. Die alchemistischen Schriften
sind Fälschungen. E. O. v. L. ISIS

XIth Century (whole and first half).

- Asín Palacios, Miguel.** ABENHÁZAM DE CÓRDOBA y su historia
crítica de las ideas religiosas. Tomo primero. 347 p. Madrid, Real
Academia de la Historia, 1927. ISIS

This imposing volume is but a pedestal to a series of others which Don
MIGUEL is preparing. It contains a very elaborate biography of IBN HAZM
of Cordova, one of the greatest philosophers of Islam and of Spain (see my
Introduction, vol. I, 713). Needless to say this biography is based upon all
the oriental documents, many of which are available only in MS. form. Much
information has been derived from IBN HAZM's own works. This volume
will be followed by others containing a complete analysis and partial trans-
lation of IBN HAZM's main work, his critical history of religions. It will be
remembered that Don MIGUEL had already translated another work of the
same author, his treatise on ethics, in 1916. The present volume is a splendid
continuation of the same great undertaking. It will help, I hope, to pull IBN
HAZM out of the obscurity wherein he has been left, partly because of his
own originality and non-conformity, almost until our days. As proof of this
unjust neglect, it will suffice to say that SOLOMON MUNK, learned as he was,
does not speak of him in his *Mélanges de philosophie juive et arabe* (1859).
G. S.

- Baer, Emil.** • Pratyabhijnâ-hridaya. Das Geheimnis des Wiedererken-
nens. Eine neuaufliebende Heilslehre des indischen Mittelalters. Aus

dem Sanskrit übersetzt, eingeleitet und mit Anmerkungen versehen.
Dissertation, Philos. Facult. I. IX + 111 p. Zürich, 1926. ISIS

Reviewed by R. F. G. MÜLLER in *Mitt. zur Geschichte der Med.*, 26, 203,
 1927.

(*Firdawsi*). *Introduction I*, 705. Fehlt die ausgezeichnete Übersetzung
 von FR. RÜCKERT (Berlin 1890). E. O. v. L. ISIS

(*Mesü Minor*). *Introduction I*, 699. Kein arabisches Original bekannt!
 richtig S. 728. E. O. v. L. ISIS

(*Salerno*). *Introduction I*, 725. RENZI enthält allerlei nicht wirklich
 Zugehöriges. E. O. v. L. ISIS

Saliba, Djémil. Étude sur la métaphysique d'AVICENNE, 215 p. Paris,
Thèse pour le doctorat d'Université, 1926. ISIS

(*Tou P'ing*). *Introduction I*, 723. Destillation war damals in China noch
 unbekannt. E. O. v. L. ISIS

XIth Century (second half).

(*Adam of Bremen*). Hamburgische Kirchengeschichte. Nach der
 Ausgabe der *Scriptores rerum Germanicarum* in dritter Auflage
 unter Mitarbeit von BERNHARD SCHMEIDLER neubearbeitet von
 SIGFRID STEINBERG. Mit einer Karte. (*Geschichtschreiber der deutschen
 Vorzeit*, Band 44). XXXVII + 272 p. Leipzig, Dyk-sche Buchhandlg.,
 1926. ISIS

Asin Palacios, Miguel. Un compendio musulmán de pedagogía. 19 p.
 Zaragoza, E. BERDEJO CASAÑAL, 1924. ISIS

Analysis of AL-GHAZZÄLI's Kitāb fātiḥat al'ulūm (Introduction to the
 sciences), of which an edition was printed in Cairo, 1322 (70 p., 1904). This
 work is of special interest because it is posterior to the Iḥyā and may be con-
 sidered an ultimate summary of the master's pedagogical views. The main
 idea is this: knowledge is not an end in itself, but a means; it is valuable
 to the extent that it increases our felicity in this life and the life to come.
 Thus his classification of the sciences is dominated by the final purpose,
 moral perfection; thence follow practical conclusions with regard to the duties
 of teachers and students. This is a very important contribution to the history
 of Muslim pedagogy. Of course it represents the very highest ideals of that
 pedagogy. Further information on this and cognate subjects may be found
 in PIERRE ARMINJON: *L'enseignement, la doctrine et la vie dans les universités
 musulmanes d'Egypte* (Paris, 1907) and GAËTAN DELPHIN: *Fas, son université
 et l'enseignement supérieur musulman* (Paris, 1889).

Bédier, Joseph. *Commentaires sur la Chanson de Roland*. Paris
 H. PIAZZA, 1927. ISIS

Reviewed by ROGER TISSERAND, *Larousse Mensuel*, 7, 455-456, Juillet 1927.

(**Chanson de Roland**). Das altfranzösische Rolandslied nach der Oxforder Handschrift. Hrsg. von ALFONS HILKA. (*Slg. Roman. Übungstexte*. Bd. 3-4). 135 p. Halle, M. NIEMEYER, 1926. ISIS

Reviewed by H. BREUER in *Deutsche Literaturzeitung*, 704-05, 1927.

(**Compass**). *Introduction I*, 764. Die chinesische Tradition, auch bei HIRTH, ist sehr unsicher. E. O. v. L. ISIS

Dalton, Ormonde Maddock. 'The Byzantine astrolabe at Brescia. *Proceedings of the British Academy*, 14 p., 3 pl. London, 1926. ISIS

Elaborate description of a large astrolabe in the Museo dell'Età Cristiana at Brescia. This monument is of great importance because the Greek inscriptions which it bears tell us that it was made for one SERGIOS THE PERSIAN, consul and protospatharios in 1062. It is wholly Byzantine: the names of the stars on the arachne are Greek, and they are all derived from the lists of PROLEMY, not a single star bears a name of Arabic derivation; in the same way the numerals are Greek throughout. This suggests that Hellenistic astronomy continued to exist, however humbly, until the time of the Fourth Crusade, when Greek civilization received the coup de grâce. G. S.

Finkel, Joshua. An eleventh century source for the history of Jewish scientists in Mohammedan countries (IBN SÂ'ID). *Jewish Quarterly Review*, 18, 45-54, 1927. ISIS

Translation of the section of IBN SÂ'ID *Ṭabaqât al-umam* (see my *Introduction*, I, 776) dealing with Jews; with notes. G. S.

(**Omar Khayyam**) *Rubâ'iyât*. Edited by FRIEDRICH ROSEN, 68 + 329 + 47 p. Berlin, KAVIANI, 1304-1926. ISIS

Reviewed in *Revue des études islamiques*, 1, 19, 1927. Very important edition.

Rosen, Friedrich. Zur Frage der Vierzeiler OMAR's des Zeltmachers (Rubâ'iyât-i-'UMAR-I-KHAYYÂM). *Zeits. d. Deut. Morgenl. Ges.*, n.F., 5, 285-313, 1926. ISIS

A study of the quatrains ascribed to OMAR. The author gives an account of previous work on the text of the *Rubâ'iyât*, and then describes an old MS. which has come into his hands, and which he has used for his recent edition (Berlin, 1925). The MS. is dated 721 (1321 A.D.), but the author considers this to be fallacious. J. S.

Ross, Sir E. Denison. OMAR KHAYYAM. *Bull. School Or. Studies*, vol. 4, pt. 3, 433-439, 1927. ISIS

A contribution towards the establishing of the text of the *Rubaiyât*. A unique MS. of date 741 (1340/41 A.D.), entitled *Mu'nis ul Ahrâr*, and containing an anthology of Persian poetry, has recently come to light. In this OMAR is represented by 13 quatrains, only two of which are already known: the

remaining 11 are probably, from the date of the compilation, to be accounted genuine. J. S.

(Seth, Symeon). *Introduction I*, 771. MOSCHUS erwähnt schon der heilige HIERONYMUS. E. O. v. L. ISIS

Yetts, W. Percival. A Chinese treatise on architecture. *Bull. School Or Studies*, vol. 4, pt. 3, 473-492, 1927. ISIS

Innumerable written records indicate a continuity of architectural practice in China lasting more than 2000 years; foreign importation has affected Chinese architecture least of all the arts. But the literature is small, — indeed the book here treated of is the sole surviving work of importance. This is *Ying tsao fa shih*, — i.e., « Method of Architecture », composed in A.D. 1070 by the Inspector of the Board of Works at the order of the Emperor of the Northern Sung Dynasty. Practically all the MS. copies that survive, however, belong to a second edition of 1145 A.D. A photolithographed facsimile was published in 1920, and a printed edition in eight magnificent volumes, in 1925. The present article is a description of the contents (including an appendix by the editor) of the 1925 edition and the sources from which it has been compiled. J. S.

XIITH Century (whole and first half).

Crummer, Le Roy. COPHO's « Anatomia Porci ». *Annals of Medical History*, 9, 180-182, 1927. ISIS

Haskins, Charles Homer. An Italian master BERNARD. Essays in history presented to REGINALD LANE POOLE, p. 211-226, Oxford, 1927. ISIS

Apropos of an Italian dictator (i.e. a teacher of the art of letter-writing). G. S.

Levy, Raphael (1900-). The astrological works of ABRAHAM IBN EZRA. A literary and linguistic study with special reference to the old French translation of HAGIN. (The Johns Hopkins Studies in Romance literatures and languages, vol. 8). v + 173 p. Baltimore, Maryland, The Johns Hopkins Press, 1927. ISIS

The eight astrological treatises completed by IBN EZRA at Lucca in 1148 exerted a deep influence not only upon the Jews but also upon the Christians. Witness the many translations. The earliest of these was a French version by one HAGIN LE JUIF in 1273, in HENRY BATE's house, Malines. This French version was not written by him, but dictated to OBERT DE MONTDIDIER; this explains that it was written not in Hebrew but in Roman characters. HAGIN's version was the basis of many Latin translations: by HENRY BATE, 1281-92; by PETER OF ABANO, 1293 (this being the only complete one); by ARNOLD of QUINQUEMPOIX, at the beginning of the fourteenth century. The Hebrew text was translated also in Catalan by MARTIN OF HUESCA, and one treatise of this Catalan version was translated into Latin in 1448 by LOUIS DE ANGULO.

LEVY's thesis is essentially devoted to a philological study of HAGIN's version.

It contains an elaborate glossary (p. 68-153), which is an important addition to French lexicography. About one hundred articles treat of words unknown in normal Old French texts and limited in use to Judaeo-French. The glossary is arranged « alphabetically and is destined to give, as a rule, 1° the form of the Old French word, 2° its definition in English, 3° its Latin translation, 4° the corresponding Hebrew term, 5° two references to passages where the word is used. » G. S.

Slover, Clark Harris. WILLIAM OF MALMESBURY and the Irish. *Speculum* 2, 268-283, 1927. ISIS

« 1) WILLIAM was interested in Irish material ; he had access to Irish documents ; and he was actively engaged in the adaptation of Irish material to the needs of Glastonbury Abbey. The Glastonbury advertisers, moreover, used Arthurian material. The work of WILLIAM, therefore, added to the Irish influence already established at Glastonbury and provided a means of contact between Arthurian romance and Irish tradition.

2) Contact between Irish tradition and English literature in general was further effected through WILLIAM's connection with the Norman court and with Arthurian literature in particular through his association with GEOFFREY OF MONMOUTH. »

Sudhoff Karl. Die erste Tieranatomie von Salerno und ein neuer salernitanischer Anatometext. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 136-154, 1 Abb., 1927. ISIS

Discussion of the misnamed *Anatomia Cophonis* and of all available MSS., and edition of a critical text. This is followed by the edition of a new *Anathomia* by a pupil of MATTHAEUS PLATEARIUS — possible URSO OF CALABRIA (?), who died in 1225. This new text is included in a MS., sometime a part of the famous Library of AMPLONIUS RATINCK de Berka, c. 1412. The great majority of AMPLONIUS' books are now in the city library of Erfurt, but this particular MS. is in the possession of Graf SCHÖNBORN zu Pommerfelden (near Bamberg). G. S.

XIITH Century (second half).

Bliemetzrieder, Franz. Über literarische Vorlagen des Liber de naturis inferiorum et superiorum des DANIEL v. MORLEY. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 338-344, 1927. ISIS

Showing DANIEL's close dependence upon ADELARD OF BATH. His liber de naturis inferiorum et superiorum was composed between 1175 and 1200. G.S.

Marx, Alexander. The correspondence between the rabbis of southern France and MAIMONIDES about astrology. Hebrew Union College Annual, vol. III, p. 311-58, 1926. (Reprint of 52 p., plus 2 p. of errata, p. 53-54.) ISIS

This is a very valuable contribution to the study of mediaeval astrology.

The rabbis of southern France had written to MAIMONIDES, who was then living in Cairo, to find out his views on astrology. MAIMONIDES told them in his letter of 1194 that he had studied the subject, reading carefully every book available in Arabic; he had reached the conclusion that the whole science of astrology was baseless foolishness. He advises the Provençal rabbis to uproot this evil tree, cut off its branches, plant instead the tree of knowledge, gather its fruit and stretch forth their hands also to the tree of life. « In his systematic method he goes back to fundamentals and points out that everything a man is to believe must be traced to one of three categories: things which can be proved by mental processes like the teachings of arithmetic and geometry, things of which the five senses can convince us, and finally things known by tradition through the prophets and wise men. Only a foolish man would believe anything beyond these categories. » He claims that the belief in the astrological ideas is responsible for the downfall of Israel. This uncompromising attack upon the most popular superstition of his day increases considerably our admiration for MAIMONIDES. He was undoubtedly one of the very greatest men of his time, too great indeed, too much ahead of it, to be thoroughly understood. I do not believe for a moment, as MARX does, that the rabbis of France accepted MAIMONIDES's revolutionary conclusions. The fact that they continued to admire him does not prove in the least that they shared his views; it takes genius of the first order to shake off such deep rooted prejudices. We may confidently assume that the views expressed by one of them, the great rabbi ABRAHAM BEN DAVID of Posquières in favor of astrology were more representative of their real opinions or feelings on the subject. And we might expect the bolder minds to adopt, not MAIMONIDES's uncompromising condemnation, but a cautious halfway attitude, such as that of SOLOMON IBN ADRET, the famous rabbi of Barcelona (c. 1300). Only the very boldest could follow MAIMONIDES to the end. It is typical enough that MARX was not able to quote more than one Jewish writer, who fully indorsed MAIMONIDES's view, and that one, ISAAC BEN PULGAR, did not flourish until the first half of the fourteenth century, i.e. almost one and a half centuries later! This memoir is followed (p. 37-52) by two original texts. 1) Letter of the Rabbis of southern France published from the unique manuscript of the Jewish Theological Seminary; 2) MAIMONIDES' letter on astrology, A.D. 1194, published on the basis of manuscripts of the British Museum, the Jewish Theological Seminary and the Library of Munich. G. S.

Miller, Konrad. *Mappae arabicae*. VI. Band. IDRISI-Atlas, 336 photographische Wiedergaben aller bis jetzt bekannten geographischen Tafeln in den Manuskripten des IDRISI auf 80 (not 82) Lichtdruck-Tafeln. Selbstverlag des Herausgebers, Stuttgart, 1927. ISIS

A full review of the whole work appeared in *Isis* 9, 458-62. The present volume contains photographs of all the IDRISI maps available today in MS. These maps (or schemes, for many are far too schematic to be considered true maps) are taken mainly from six MSS. of the Book of ROGER and of the greater IDRISI map; two of these MSS. are in Oxford, the four others in Paris, Constantinople, Leningrad and Cairo. Photographs of the MSS. of the smaller IDRISI map are also reproduced, the reproductions being placed near the corresponding sections of the greater map. The three last plates (78 to 80) contain reproductions of the world map of AL-SFAXI (1592-1601) after a Paris MS.

G. S.

Vacarius. *Liber pauperum.* Edited for the Selden Society by F. DE ZULUETA. London, QUARITCH, 1927. ISIS

XIIIth Century (whole and first half)

Krumbhaar, E. B. The stigmata of ST. FRANCIS OF ASSISI. *Annals of Medical History*, 9, 111-119, illustrated, 1927. ISIS

Sudhoff, Karl. Der « Micrologus » Text der « Anatomia » RICHARDS DES ENGLÄNDERS. *Archiv für Geschichte der Medizin*, 19, 209-239, 1927. ISIS

« Dass zwischen dem Schriftwerk oder der literarischen Persönlichkeit des supponierten « RICARDUS SALERNITANUS » und des leibhaftigen « RICARDUS ANGLICUS » eine wirkliche Trennung nicht möglich sei, habe ich schon vor 5 Jahren ausgesprochen. Kurz nachher liess ich durch einen meiner Schüler (H. H. BEUSING, 1922) den Nachweis versuchen, dass es einen konstruierten medizinischen Autor « RICARDUS » in Salerno niemals gegeben habe und trat dann auch selbst mit meinem Namen hinter dies Untersuchungsergebnis, zugleich die ganze Persönlichkeit des « RICARDUS ANGLICUS », der auch « RICARDUS PARISIENSIS » genannt wird, mit einigen festen Strichen zu umreissen versuchend (*Janus*, 1924, 397-403). Dass damit das geistige Bild des Mannes noch nicht wirklich erschöpfend gewonnen ist, weiss niemand besser als ich. Vor allem harrt noch sein « Micrologus » der wirklichen literarischen Auferstehung, und als Vorarbeit zu einer solchen ist die ursprüngliche Textgestalt der anatomisch-physiologischen Beschreibung des Menschenkörpers edierend aus den Handschriften festzulegen, wie « RICHARD DER ENGLÄNDER », hochbetagt 1252 in London verstorben, sie in jungen Jahren zu Paris für diesen einführenden Abriss der gesamten Medizin ausgearbeitet hat, als « Anatomia ».

XIIIth Century (second half).

Bragman, Louis J. Some medical observations of MARCO POLO. *Medical Life*, 34, 313-315, 1927. ISIS

Chapman, Conrad. MICHEL PALÉOLOGUE, restaurateur de l'empire byzantin (1261-1282). *Thèse*. 204 p., 2 grav., 2 cartes. Paris, FIGUËRE, 1926. ISIS

Harris, Charles Reginald Schiller. DUNS SCOTUS. Two volumes. ix + 380 + 401 p. Oxford, Clarendon Press, 1927. ISIS

Johnsson, J. W. S. Zur Geschichte des rothaarigen Mannes, im Manuskript Ny k. S. 84b in der königlichen Bibliothek zu Kopenhagen. *Janus*, 31, 304-17, 1 pl., 1927. ISIS

« Wenn wir nun den Schluss aus unserer Untersuchung ziehen wollen, so ergibt sich, dass wir in Blatt 6 aus dem Manuskript Ny k. S. 84 b eine Aderlasstafel vor uns haben, die als Plakat in der Badstube eines Klosters

aufgehängt war, Der Text entstand mit Zuhilfenahme einer Handschrift der Ketham-Serie in den Jahren um 1400, wahrscheinlich unter dem Einfluss der grossen Badereform des Jahres 1370. »

- Lippmann, Edmund O. von.** Der persische Dichter SAADÎ über den Zucker (Aus der in Vorbereitung befindlichen Neuauflage der « Geschichte des Zuckers » : Abschnitt VI, Absatz 33.) *Die Deutsche Zuckerindustrie*, Berlin, Nr. 19; pp. 521-522, 1927. ISIS

- Little, Andrew George.** THOMAS DOCKING and his relations to ROGER BACON. Essays in history presented to REGINALD LANE POOLE, p. 301-331, Oxford, 1927. ISIS

THOMAS GOOD or THOMAS DOCKING (after his birthplace in Norfolk) was seventh lector to the Friars Minor at Oxford; he was still at Oxford in 1269; he wrote biblical commentaries of enormous length. He had some interest in physical science and derived some of his ideas from BACON. He was a lovable man but of no importance from our point of view. G. S.

- Tállgren, O. J.** Los nombres árabes de las estrellas y la transcripción alfonsina. Homenaje a MENÉNDEZ PIDAL, tomo II, pp. 634-718. Madrid, 1925. ISIS

See additions and corrections in *Revista de fil. española*, 12, 400-01, 1925. The purpose of this study of the Alphonsine astronomy is primarily philological, phonetical. G. S.

- Webb, Clement Charles Julian.** ROGER BACON on ALPHONSE OF POITIERS. Essays in history presented to REGINALD LANE POOLE, p. 290-300, Oxford, 1927. ISIS

« The object of the following pages is to call attention to a curious notice by a contemporary writer of the medical treatment adopted in the case of ALPHONSE, Count of Poitiers and of Toulouse, the brother of ST. LOUIS, who is known to students of the history of France in the thirteenth century to have suffered from some kind of paralysis, and also from an affection of the eyes. The writer in question is no less celebrated a person than ROGER BACON, and his reference to the matter is to be found in his commentary on the pseudo-Aristotelian *Secretum Secretorum*. »

XIVth Century (whole and first half).

- Asín Palacios, Miguel.** La escatología musulmana en « La Divina Comedia », 103 pp. Madrid, Tipografía de la « Revista de Archivos, » 1924. ISIS

A critical study of the discussions which have been started by ASÍN's views on the Arabic sources of the Divine Comedy. (For a statement of these views, see *Isis*, 10, 65-8). This study appeared simultaneously in the following journals: *Il giornale Dantesco* (Firenze, vol. 26, 1923-24), in its original Spanish form; *Revue de littérature comparée* (Paris, 1924), abbreviated French version;

Litteris (Lund, 1924), abbreviated English version. It contains an alphabetical catalogue of all the critics, indicating where and when their reviews appeared and whether they were favorable or not, and to what extent. Then follow a history of the controversy, year by year (1919 to 1923), a classification of the objections, and the author's answers to them. I do not believe that any literary polemic has ever stirred the Republic of Letters as deeply as the one started by the learned professor of Madrid University. G. S.

Baudry, L. Fragments inconnus de G. d'OCCAM : le *Tractatus de principiis theologiae*. C. R. *Ac. Inscr. et Belles-lettres*, janv.-mars 1927, 46-55. ISIS

Le texte du *Tractatus de principiis theologiae*, attribué à GUILLAUME d'OCCAM par PIERRE DE CANDIE, était jusqu'à présent inconnu; BAUDRY croit l'avoir découvert dans le Ms latin 16130 de la Bibliothèque nationale (142 feuillets de la fin du XIV^e siècle). Mais, de l'étude de ce texte, il croit pouvoir conclure que le rédacteur de ce *Tractatus* n'est pas, malgré l'affirmation de P. DE CANDIE, GUILLAUME d'OCCAM, mais un personnage anonyme du milieu du XIV^e s. cherchant à s'assimiler sa doctrine et à en dégager les idées fondamentales. Par la même occasion, BAUDRY est amené à affirmer que le *De successivis* n'est pas non plus une œuvre authentique de GUILLAUME d'OCCAM, mais une compilation anonyme. L. G.

Gilbert, Allan H. DANTE's conception of justice. x + 244 p. Durham, N. C., Duke University Press, 1925. ISIS

Reviewed by KENNETH MCKENZIE, *Speculum* 2, 346-349, 1927.

Hochstetter, Erich. Studien zur Metaphysik und Erkenntnislehre WILHELMS VON OCKHAM. VIII + 179 p. Berlin, W. de Gruyter, 1927. ISIS

Irsay, Stephen d'. Defense reactions during the Black Death, 1348-1349. *Annals of Medical History*, 9, 169-179, 1927. ISIS

Longré, E. Questions inédites de MAÎTRE ECKHART, O. P., et de GONZALVE DE BALBOA, O. F. M. *Rev. néoscholastique de philo.*, 27, 69-85, 1927. ISIS

Publication d'un extrait du Ms 1071, de la bibliothèque municipale d'Avignon.

(**Ockham, William of**). The *De imperatorum et pontificum potestate* of WILLIAM OF OCKHAM. Edited by C. KENNETH BRAMPTON. xxxviii + 108 p. Oxford, Clarendon Press, 1927. ISIS

Reviewed in *American Historical Review*, 33, 107-108, 1927.

Previté-Orton, Charles William. The authors cited in the *Defensor Pacis* (of MARSILIUS OF PADUA). Essays in history presented to REGINALD LANE POOLE, p. 405-420, Oxford, 1927. ISIS

, XIVth Century (second half).

Cowley, Arthur Ernest. The Magna Chirurgia of GUY DE CHAULIAC. Essays in history presented to REGINALD LANE POOLE, p. 1-4, 1 pl., Oxford, 1927. ISIS

A propos of fragments found in the binding of MS. Hunt 175 of the Bodleian. These fragments contain part of a Portuguese translation of CHAULIAC's Magna chirurgia written in Hebrew characters. They were written, probably in Portugal, not later than 1450. G. S.

Emerton, Ephraim. Humanism and tyranny. Studies in the Italian Trecento. x + 377 p. Cambridge, Mass., Harvard University Press, 1925. (four dollars). ISIS

The bull *Unam sanctam* of BONIFACE VIII (1302) may be considered the most complete expression of the mediaeval ideal, the climax of "the greatest of Christian centuries", but it was promptly followed by the "crime of Anagni" (1303), which was the abrupt beginning of a new world. Feudal and clerical politics were gradually replaced by national and bourgeois ideals. So soon after its greatest triumph, the Church had to face one of its most terrible crises, one which was not healed until the Council of Constance more than a century later (1414-18). In fact, religious problems ceased from now on to occupy the center of the political stage. More and more importance was necessarily given to fiscal questions. "The history of the English Parliament, of the French Estates General, of the German Reichstag, the Spanish Cortes, and notably of the Italian republican institutions, is one long story of the transition of European society from an economy of barter to an economy of money and credit."

The present book contains in English translation an interesting series of documents illustrating political thought in the second half of the fourteenth century. (1) COLUCCIO SALUTATI (1331-1406). Treatise on tyrants, written in 1400. SALUTATI was a Guelph and during his long administration of Florentine foreign policy, his main concern was to check Milanese imperialism. (2) BARTOLUS's treatise on tyranny, written probably towards the end of his life (1357). This is, as we would expect, more strictly juridical. (3) Biography of a typical tyrant of that time, the Ghibelline FRANCESCO DEI ORDELAFFI of Forlì, in Romagna. (4) Selections from the *Constitutiones Egidiane*, the code promulgated by the Cardinal-legat EGIDIO ALBORNOZ at Fano in 1357. This code remained in vigor until 1816; it is one of the most interesting monuments of medieval legislation. (5) BARTOLUS's treatise on Guelphs and Ghibellines. (6) SALUTATI's letters in defense of liberal studies (i.e. Greek and Latin literature). For details, I must refer to the excellent prefaces. In one of them for example, the author gives a luminous account of Guelphism and Ghibellinism, by means of comparisons with the English and American "parties". Taken by and large, Ghibelline meant Tory, Conservative, or Republican; Guelph, Whig, Liberal, or Democrat. The "Parte guelfa" of Florence has its most perfect counterpart in Tammany Hall!

These treatises on tyranny are of special interest today because the destinies of Italy are again in the hands of a tyrant. Now, as in the fourteenth century there can be no justification for such an evil, except the fear of a greater one, chaos and self-destruction. The most terrible aspect of the situation is that

it is apparently incurable, or at any rate, that it can not be cured without considerable pain and danger. No people has ever learned the use of freedom without it. MUSSOLINI's reign can not be more than an episode in the life of Italy, but what will happen next? Admitting that he has saved Italy in a time of chaos, does this give him the right to jeopardize her future? G. S.

Galbraith, Vivian Hunter. The Anonimale Chronicle, 1333 to 1381. From a (French) MS. written at St. Mary's Abbey, York. Manchester, University Press, 1927. ISIS

Whitney, (Rev.) James Pounder. A note on the work of the Wyclif Society. Essays in history presented to REGINALD LANE POOLE, p. 98-114, Oxford, 1927. ISIS

XVth Century (whole and first half).

Battistini, Mario. GIOVANNI CHELLINI, medico di S. Miniato. *Riv. di storia d. sc. med. e natur.*, 18, 106-117, 1927. ISIS
GIOVANNI CHELLINI (1373? — 1462, 02, 04), riche médecin établi à Florence. L. G.

Lippmann, Edmund O. von. Ein Wunder bei der Harn-Beschauung. *Mitt. zur Geschichte der Medizin*, 26, 161, 1927. ISIS
Anecdote relative to fantastic uroscopy as related in the Mustataf of MUHAMMAD IBN AHMAD AL-KHATIB AL-ABSHIHI (d.c. 1446). G. S.

Schevensteen, A. F. C. van. De hygiënische maatregelen van het magistraat van Antwerpen in de 15de eeuw. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 329-42, 1927. ISIS

XVth Century (second half).

Ballard, James F. Medical incunabula in the William Norton Bullard Collection. *Boston Medical and Surgical Journal*, 196, 865-875, May 26, 1927. ISIS

Birnbaum, Karl. Zur Psychiatrie des späten Mittelalters. *Deutsche medizinische Wochenschrift*, 1058-1059, 1927. ISIS

Hommel, Fritz. Zum Leben des HIERONYMUS BRUNSCHWYCK. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 155-157, 1927. ISIS

(Moyllus, Damianus). A newly discovered treatise on classic letter design. Printed at Parma by DAMIANUS MOYLLUS, circa 1480. Reproduced in facsimile. With an introduction by STANLEY MORISON. 82 p. Paris, The Sign of the Pegasus, 1927. ISIS

Polain, Louis. Marques des imprimeurs et libraires français du xve siècle. T. 1. Des documents typographiques du xv^e S. 120 p. Paris, E. DROZ, 1925. ISIS

C. R. de C. DALBANNE in *Rev. des bibliothèques*, 36^e année, 342-8, 1926.

Schwäbl, Franz. Ein Wandgemälde in der Hohen Schule in Ingolstadt aus der Gründungszeit der Universität. Sammelblatt des Histor. Vereines Ingolstadt, S. 113 ff., 1926. ISIS

Sigerist, Heinrich E. Kritische Betrachtungen über die Frühgeschichte der Syphilis. *Deutsche Medizinische Wochenschrift*, Nr. 25, 1926. ISIS

SIGERIST has carefully examined the recent literature devoted to the origin of syphilis and found that nine tenths of it is scientifically worthless. The contributions of two authors seemed to him worth considering: (1) Prof. DOHI of Tokyo: Beiträge zur Geschichte der Syphilis insbes. über ihren Ursprung und ihre Pathologie in Ostasien (Tokyo, 1923). DOHI has examined early Chinese and Japanese works and found no trace of syphilis knowledge in them. He concludes that that disease did not exist in the Far East, until it was introduced by the Portuguese in Canton in 1505 and in Japan in 1512. Now Asia and Europe had been in touch since the time of ALEXANDER THE GREAT. Hence if syphilis had existed in Europe before COLUMBUS, it would have occurred also in the Far East. Ergo... But SIGERIST points out that it was not so much syphilis which was introduced by the Portuguese, as the knowledge of it.

(2). HILDEBRAND has studied various literary texts by ODO OF CLUNI (879-942), SEXTUS AMARCIUS (XIth cent.), GUILLAUME DE BLOIS (XIIth cent.) and SAINT HILDEGARD, and thinks they contain allusions to syphilis. This is very vague and altogether unconvincing.

I quote SIGERIST's final conclusion *verbatim* because of its wisdom: « Mir persönlich scheint die amerikanische Theorie die unwahrscheinlichere zu sein. Ich kann mir sehr gut denken, dass die Syphilis gegen Ende des Mittelalters in Europa tatsächlich, wenn auch unerkannt vorkam, dass man eines Tages in einem Zeitalter erhöhter Naturbeobachtung auch diese Krankheit von anderen unterscheiden lernte, dass diese Kenntnis wie ein Lauffeuer durch die Welt zog, dass man die neue Krankheit mit der neuen Welt in Zusammenhang brachte und an dieser Theorie festhielt, besonders da massgebende Wirtschaftskreise, die Guajakimporteure, an dieser Theorie interessiert waren. Die ganze Argumentenkette, die SUDHOFF und seine Anhänger aufgestellt haben, scheint mir aus historischen und medizinischen Gründen recht einleuchtend. Aber ich bin mir bewusst, dass es sich auch hier nur um eine Hypothese handelt, die nicht bewiesen werden kann, dass von irgendwelcher Sicherheit nicht die Rede sein kann, dass wir bereit sein müssen, diese Hypothese fallen zu lassen, falls sich die Gegengründe als wahrscheinlicher erweisen. »

We may believe many things about the origin of syphilis, but we *know* nothing, and it is probable that we shall never *know* anything with certainty.

G. S.

Sudhoff, Karl. Zur Lebensgeschichte BURKHARDS VON HORNECK

(gest. 1522). *Archiv für Geschichte der Medizin*, 19, 299-300, 1927.

ISIS

Leonardo da Vinci.

Favaro, Giuseppe. Il peso del corpo umano negli studi di LEONARDO. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, p. 162-176, 1926. ISIS

Marcolongo, Roberto. Le invenzioni di LEONARDO DA VINCI. P. 1a : Opere idrauliche, Aviazione. P. 2a : Arte militare, Meccanica pratica. *Scientia*, 41, 245-254, 393-402, 1927; trad. franç., supplém., 99-106, 159-167. ISIS

Indication rapide des sources où a pu puiser LÉONARD, et énumération de ses inventions. L. G.

Marcolongo, Roberto. La meccanica di LEONARDO DA VINCI. *Scientia*, 40, 277-286, 1926; trad. franç. id., suppl., 93-101. ISIS

« Procureremo di mostrare... quali fossero le conoscenze matematiche di LEONARDO; quale fosse lo stato della meccanica ai suoi tempi; quello che egli ha potuto apprendere dai suoi predecessori; quali sono stati il suo contributo e le sue scoperte. »

Scheer, Hermann. Die Einheit des Organischen im Werke LEONARDOS. Ansätze zu einer Deutung aus den anatomischen Blättern. *Archiv für Geschichte der Medizin*, 19, 318-330, 3 pl., 1927. ISIS

XVIth Century (whole and first half).

B. — Physical sciences and Technology.

Darmstaedter, Ernst. BENVENUTO CELLINI und seine Abhandlung über die Goldschmiedekunst. *Kultur des Handwerkes*, 7. Heft, 226-231, Juni 1927. ISIS

Wickersheimer, Ernest. Fumées industrielles et établissements insalubres à Rouen en 1510. *Annales d'Hygiène publique, industrielle et sociale*, 5^e année, 9 p., Septembre 1927. ISIS

C. — Natural Sciences.

Spis o nových zemích a o novém světě. (On the new lands and the new world). Z prachu knihoven, Svazek 2. 96 p., Praha I, Beneditřská 9, 1926. ISIS

Facsimile reprint of an early Czech booklet, printed by MIKULÁŠ BAKÁLAŘ, who was already printing in Plzeň (Pilsen) in 1488, and died in 1520. This pamphlet is a translation of a letter of « ALBERICUS » VESPUCCI to LORENZO PIERO FRANCESCO DI MEDICI; the Italian original of this letter is lost; a Latin

translation by JOCUNDUS, was printed in 1504. The Czech translation appeared at about the same time. The facsimile is followed by a reprint in Czech, English and Spanish translation and a note (in English and Spanish) by C. STRAHA, Librarian of the Strahov Monastery. This is a very elegant publication. G. S.

Stevenson, E. L. The geographical activities of the Casa de contratacion, *Annual report of the American Historical Association for the year 1922*, vol. I., p. 305-06, Washington, 1926. ISIS

D. — *Medical Sciences.*

Paracelsus. Volumen paramirum. (Von Krankheit und gesundem Leben). Herausgegeben und erläutert von JOH. DANIEL ACHELIS. 170 Seiten, 1 Port. Jena, DIEDERICH, 1928. (br. M 4.50, geb. M. 6.50). ISIS

This edition is largely based upon JOHANN HUSER's Opera. It is preceded by an introduction (of 45 p.) and by a commentary (of 55 p.) both of which are subdivided in the same way as the text. This is convenient, though less so than if the notes had been printed at the bottom of the pages to which they refer. The purpose of this new edition will be best explained by using the very words printed on the jacket : " Der Heilkunde des PARACELSUS liegt die Weltanschauung von der Einheit alles Lebens zugrunde, in die auch der Mensch eingefügt und deren Ordnungen er unterworfen ist. Fällt er aus einer dieser Ordnungen heraus, so wird er krank und kann nur durch eine Gesamtbehandlung der inneren und der äusseren Ursachen in die ihm gemässe Ordnung zur Gesundung zurückgeführt werden. Deshalb ist für PARACELSUS die Gesamtbehandlung des Menschen, die seelische und körperliche gleich wichtig. Damit berühren sich seine Anschauungen mit der gegenwärtigen Krisis in unserer medizinischen Wissenschaft, die ebenfalls von der Spezialbehandlung sich löst und zur Gesamtbehandlung des ganzen Menschen übergeht. So antwortet PARACELSUS uns auf die immanen Fragen der heutigen Zeit. Durch eine umfangreiche Einleitung und durch ausführliche Anmerkungen macht der Herausgeber, der Mitarbeiter SUDHOFFS an der Gesamtausgabe der Schriften von PARACELSUS, dieses wichtige Werk allgemein verständlich und praktisch nutzbar. " G. S.

E. — *Alia.*

Epistolae obscurorum virorum. Bd. I. und II. Hrsg. von ALOYS BÖMER. (Stachelschriften hrsg. von G. A. E. BOGENG. Ältere Reihe, I, 1,2). 165 S., 192 S. Heidelberg, RICH. WEISSBACH, 1924. ISIS

Fischer, Ludwig. VEIT TROLMANN VON WEMDING genannt VITUS AMERPACHIUS als Professor in Wittenberg (1530-1543). (*Stud. und Darst. a.d. Gebiet d. Geschichte* hrsg. von H. VON GRAUERT, X. Bd., H. 1). x + 215 p. Freiburg, HERDER & Co., 1926. ISIS

Reviewed by PAUL JOACHIMSEN in *Deutsche Literaturzeitung*, 1170-1171, 1927.

Kalkoff, Paul. Humanismus und Reformation in Erfurt (1500-1530). VI + 98 p. Halle, Buchh. d. Waisenhauses, 1926. ISIS

Reviewed by PAUL JOACHIMSEN in *Deutsche Literaturzeitung*, 1070-1075, 1927.

Landucci, Luca (1436?-1516). A Florentine diary from 1450 to 1516. Continued by an Anonymous writer till 1542, with notes by IODOCO DEL BADIA. Translated from the Italian by ALICE DE ROSEN JERVIS. Portrait and plates. London, DENT, 1927. ISIS

Mangan, John Joseph. Life, character, and influence of DESIDERIUS ERASMUS of Rotterdam. Two volumes. XVIII + 404 p., VII + 427 p. New York, MACMILLAN, 1927. ISIS

Reviewed in *American Historical Review*, 33, 108-110, 1927.

Pearson, Karl. On the skull and portraits of GEORGE BUCHANAN *Biometrika*, 18, 233-256, 32 pl., 1926. ISIS

XVth Century (second half).

B. — Physical Sciences and Technology.

Dalton, Ormonde Maddock. CROFT LYONS bequest of early dials and other instruments. *British Museum Quarterly*, 1, 76-77, 1 pl., 1926. ISIS

This note is inserted here with special reference to the horizontal dial made by ERASMUS HABERMEL of Prague, instrument maker to RUDOLF II and TYCHO BRAHE, who had worked before at Regensburg and Augsburg G. S.

C. — Natural Sciences.

Luke, Harry Charles. A Spanish Franciscan's narrative of a journey to the Holy Land. Translated from the sixteenth century manuscript and edited with notes. VII + 83 p. London, Palestine Exploration Fund, 1927. ISIS

Martinotti, Giovanni. COSTANZO VAROLIO (1543-75) e il suo metodo di sezionare l'encefalo. 15 p. (*Studi e memorie per la storia dell' Università di Bologna*, vol. 9). Imola, PAOLO GALEATI, 1926. ISIS

(**Montserrat, Antonio**). The commentary of Father MONTSERRATE, S. J. on his journey to the court of Akbar. Translated from the original Latin by JOHN S. HOYLAND, and annotated by S. N. BANERJEE. LXVIII + 220 p. Bombay, Oxford University Press, 1922. ISIS

Reviewed by R. P. DEWHURST, *Journal of the Royal Asiatic Society*, 678-680, 1924.

Wagner, Henry Raup. Sir FRANCIS DRAKE's voyage round the world : its aims and achievements. 543 p., illus. San Francisco, JOHN HOWELL, 1927. ISIS

D. — *Medical Sciences.*

Brunn, W. von. Fragment des Gichtbuches eines Stralsunder Amtschirurgen des 16. Jahrhunderts. *Archiv für Geschichte der Medizin*, 19, 287-293, 1 Fig., 1927. ISIS

Delmas, Paul. Le vrai visage de LAURENT JOUBERT. *Aesculape*, 17, 118-19, 1927. ISIS
Biographie et portrait de LAURENT JOUBERT (1529-1583), traducteur et commentateur de GUY DE CHAULIAC. L. G.

Lint, J. G. de. BARTHELEMY CABROL, chirurgien du XVI^e siècle. *Bull. Soc. Hist. Méd.*, 21, 169-180, 1927. ISIS

Lint, J. G. de. Le chirurgien JEROME FABRICE AB AQUAPENDENTE (1537-1619). *Bull. Soc. Hist. Méd.*, 21, 181-190, 1927. ISIS

Morpurgo, Edgardo. La spezierie a Padova durante la peste del 1575-1576. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, p. 47-51, 1926. ISIS

Morpurgo, Edgardo. Un Trattato sulla « melancholia » di un medico italiano della seconda metà del Cinquecento. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, p. 38-44, 1926. ISIS

The physician alluded to in the title is ERCOLE SASSONIA, born in Padova 1551. G. S.

Nuyens, B. W. Th. Een autograaf van Mr. ADRIAEN VAN DEN SPIEGEL (1585). *Bijdragen tot de geschiedenis der geneeskunde*, 7, 491-498, 1927. ISIS

Pictor's Tract on the treatmeot of the renal calculus (1557). Facsimile, with English translation, by CHARLES GREENE CUMSTON. v + 35 + 63 p. London, ROUTLEDGE, 1925. (not seen). ISIS

E. — *Alia.*

Atanassiévitch, Xénia. L'influence des pythagoriciens sur un philo-

sophe italien. *Rev. de l'Université de Bruxelles*, 32, 400-408, 1927.

ISIS

L'auteur montre comment l'hypothèse fondamentale de GIORDANO BRUNO « le minimum est la substance des choses » est établie sous l'influence du pythagorisme.

L. G.

Conley, Carey Herbert. First English translators of the classics. 158 p. New Haven, Yale University Press, 1927.

ISIS

Connes, Georges. Le mystère shakespearien. 264 p., portr. Paris, BOIVIN, 1926.

ISIS

Forster, Edward Seymour. The Turkish letters of OGIER GHISELIN DE BUSBECQ (1522-1592), imperial ambassador at Constantinople, 1554-1562. Newly translated from the Latin of the Elzevir edition of 1633. Oxford, University Press, 1927.

ISIS

Roberts, Griffith (fl. 1567-85). A Welsh grammar : and other tracts. 264 p. Carmarthen, W. SPURRELL and Son, 1927.

ISIS

XVIIth Century (whole and first half).

A. --- Mathematics.

Biancoli, Bruno. GALILEO. *L'arduo*, 2, 18-22, 130-135, 1922.

ISIS

Bosmans, H. (S. J.) A propos de la correspondance de DESCARTES avec CONSTANTIN HUYGENS récemment publiée par M. LÉON ROTH. L'auteur principal de l'Onwissen wiskontenaer I. I. STAMPIONIUS ontdeckt door JACOBUS A WAESSENAER (Leyde, 1640). *Rev. des quest. scientif.*, 11, 113-141, 1927.

ISIS

La correspondance de DESCARTES avec CONSTANTIN HUYGENS récemment publiée par LÉON ROTH (*Isis*, 9, 434-7) fait tomber les derniers doutes qui pouvaient s'élever sur le fait que DESCARTES est le véritable auteur de ce « Faux Mathématicien I. I. STAMPION découvert », JACOB WASSENAER n'étant que le secrétaire qui traduit et qui signe. L'auteur fait l'histoire de la querelle latente entre DESCARTES et JEAN JANZ STAMPION le jeune depuis 1633, mais que fit éclater en 1639 l'apparition de l'*Algebra of te nieuwe Stel-Regel* de STAMPION, *Algebra* qui n'était qu'un pastiche de la *Géométrie* de DESCARTES. Mauvais mathématicien, ce STAMPION eut l'honneur d'être le premier maître en mathématiques du grand HUYGENS.

L. G.

Cajori, Florian. The logarithms of NAPIER. *Science*, 65, 547, 1927.

ISIS

Duclaux, (Agnes) Mary (Frances). Portrait of PASCAL. Portr. New York, Harper, 1927.

ISIS

Weis, Friedrich. EVANGELISTA TORRICELLI in seiner gesamten wissenschaftlichen Bedeutung unter besonderer Berücksichtigung der bis zum Ende des Jahres 1925 erschienenen Literatur. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 250-281, 1927. ISIS

B. — *Physical Sciences and Technology.*

von Dyck W. and Caspar, M. (editors). « Nova Kepleriana. Wieder gefundene Drucke und Handschriften von JOHANNES KEPLER. 4. Die Keplerbriefe auf der National-bibliothek und auf der Sternwarte in Paris », *Abhandlungen der Bayerischen Akademie der Wissenschaften, Mathematisch-naturwissenschaftliche Abteilung*, vol. 31, Abh. 1, 1927. 114 pp. ISIS

In two of these Abhandlungen, in volume 25, Dr. VON DYCK published KEPLER's « Prognostica », of the years 1604 and 1624, found in the Munich state library, and KEPLER's « Glaubenserkenntnis » of the year 1623 found in Wittenberg. In volume 28 of the Abhandlungen appeared KEPLER's correspondence with EDMUND BRUCE which Dr. VON DYCK found in the British Museum. In the present article he presents a fourth batch of KEPLER material, namely eleven KEPLER documents dated 1622-1630, and letters of JACOB BARTSCH (KEPLER's son-in-law) and PETER CRÜGER to PHILIP MÜLLER, 1620-1635. (*Isis*, 1, 158; 5, 229; 7, 215). R. C. A.

Engelmann, Max. Schraubenmikrometer-Erstlinge. *Archiv für Geschichte der Mathematik, der Naturwissenschaften, und der Technik*, 10, 294-302, 5 Abb., 1927. ISIS

The micrometer-screw is often said to have been invented by WILLIAM GASCOIGNE, 1640. ENGELMANN describes two micrometer-screws, kept in the mathematical museum of Dresden: the one invented in 1609 by LUCAS BRUNN and constructed in 1619 by CHRISTOPH TRECHSLER, father and son; the other in an instrument built by MATTHAEUS HEINTZ of Zwickau, in 1631. G. S.

Hoppe, Edmund. MARCUS MARCI de Kronland. Ein vergessener Physiker des 17. Jahrhunderts. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 282-290, 1927. ISIS

MARCUS MARCI (1595-1667), disciple of GREGORIUS DE ST. VINCENTIO who taught mathematics in Prague 1629-31, was himself more of a physicist than a mathematician. The *De proportionibus motus* published by him in 1639 contains some valuable mechanical ideas mixed with errors. The same mixture of truth and error is found in his *Thaumantias liber de arcu coelesti deque colorum apparentium natura, ortu et causis* (Prague, 1648), but this work is very important because it contains the germ of the Newtonian theory of colors. Says the author « Wenn man heute in Betrachtungen zum 200 jährigen Todestage liest, dass NEWTON allein das Verdienst habe, den Nachweis er-

bracht zu haben, dass das Licht aus homogenen Strahlen bestehe, so entspricht das nicht der Wirklichkeit. Man muss vielmehr sagen : Der Gedanke, dass die farbigen Strahlen das weisse Licht bilden, also die einzelnen Theile desselben sind, geht bis auf MAUROLICUS (*Photismi de lumine et umbra* 1575) zurück, dass dieselben homogen sind, ist zuerst bewiesen von MARCUS MARCI 1648. Dass die Wiedervereinigung aller Farber des Spektrums durch eine passende Linse weiss ergibt, hat NEWTON zuerst bewiesen. »

Wenzel, A. GALILEI. VIII + 74 p., 10 fig. Berlin, OTTO SALLE, 1927.
ISIS

C. — *Natural Sciences.*

Barzini, Luigi. Le più belle pagine di FRANCESCO CARLETTI. Milano, TREVES, 1926.
ISIS

Hondius, Jodocus. Reproductions of early engraved maps. 1 : The map of the world on MERCATOR's Projection, by JODOCUS HONDIUS, Amsterdam, 1608. From the unique copy in the collection of the Royal Geographical Society, with a memoir by EDWARD HEAWOOD. 26 sheets, 20 in. by 15 in., in paper cover. Memoir, 24 p. London, Royal Geographical Society, 1927.
ISIS

Lawson, William. (fl. 1618). A new orchard and garden : or, the best way for planting, grafting, and to make any ground good for a rich orchard : particularly in the north, and generally for the whole common-wealth, as in nature, reason, situation, and all probability, may and doth appear. With the country house-wife's garden for herbs of common use. Their virtues, seasons, ornaments, variety of knots, models for trees, and plots, for the best ordering of grounds and walks. As also the husbandry of Bees, with their several uses and annoyances : all being the experience of forty eight years labour, by WILLIAM LAWSON, reprinted from the third edition with a preface by ELEANOUR SINCLAIR ROHDE. Whereunto is newly added the art of propagating plants with the true ordering of all manner of fruits, in their gathering, carrying home, and preservation. London, The Cresset Press, 1927.
ISIS

Reprint of this work of which the first edition appeared in 1618. It « ranks with GERARD's Herball and PARKINSON's Paradisus among the classics of English garden literature. WILLIAM LAWSON was the author of the earliest book written for north-country gardeners, and in his New Orchard and Garden he includes the first known plan of a Yorkshire garden, which is here reprinted. His Country Housewife's Garden is remarkable as being the earliest book avowedly written for women gardeners. Miss ELEANOUR SINCLAIR ROHDE, whose name is familiar to all lovers of early English garden literature (see *Isis*, 5, 457-61; 8, 622), deals in detail with the small, homely garden of Elizabethan times. »
G. S.

D. — *Medical Sciences.*

Dorveaux, Paul. Le baume vert de Metz. *Bull. Soc. hist. de la pharmacie*, 307-14, oct. 1926.

ISIS

Ce baume vert de Metz (*Balsamus vulnerarius Metensium*), imaginé par SAMUEL DUCLOS (Metz 1589, 11, 18- id., 1684, 01, 21), et qui doit sa couleur au verdet qui figure dans sa composition, était employé surtout contre les suppurations; sa réputation a survécu jusqu'à nos jours, car il a été maintenu dans la dernière édition de l'Officine, de DORVEAULT (16^e éd., p. 449, Paris, 1923).

L. G.

Scaturro, Alberto. MARC ANTONIO ALAYMO (1590-1662) e i suoi « Consigli politico-medici per l'occorenti necessità di peste ». *Arch. di storia d. scienza*, 7, 216-225, 1926.

ISIS

Etude bio-bibliographique sur ce médecin de Palerme. L'ouvrage dont s'occupe SCATURRO, bien qu'imprimé seulement en 1652, renferme des descriptions, des préceptes, tirés surtout de l'épidémie de peste qui sévit en Sicile en 1624-26.

L. G.

Wilson, F. P. The plague in SHAKESPEARE's London. XII + 228 p., 16 pl. Oxford, Clarendon Press, 1927.

ISIS

Deals mainly with the outbreaks of 1603 and 1625.

E. — *Alia.*

[**Boehme, Jacob** (1575-1624)]. Gedenkgabe der Stadt Görlitz zu seinem 300 jährigem Todestage. Herausg. von RICHARD JECHT. Im Selbstverlag des Magistrates der Stadt Görlitz, II + 132 S., Görlitz, 1924.

ISIS

Compte rendu de A. KOYRÉ in *Rev. de l'hist. des religions*, 93, 328-333, 1926.

Chatterton, Edward Keble. JOHN SMITH (1580-1631). The Golden Hind Series. London, JOHN LANE, 1927.

ISIS

Koyré, A. La littérature récente sur JACOB BOEHME. *R. de l'hist. des religions*, 93, 116-128, 1926.

ISIS

Examen des trois ouvrages suivants : PAUL HANKAMMER, JACOB BOEHME, *Gestalt und Gestaltung*, 430 p., F. COHEN, Bonn, 1924; PENCKERT, *das Leben JACOB BOEHME's* 185 p., DIETRICH, Jena, 1924; BORNHAMM, LUTHER und BOEHME (*Arbeiten zur Kirchengeschichte*, H. 2, 1925).

L. G.

Taylor, Alfred Edward. FRANCIS BACON. (The British Academy : Annual Master-Mind Lecture, Henriette Hertz Trust.) (From the *Proceedings of the British Academy*). 24 p. London, Oxford University Press, 1927 (1926).

ISIS

- Wright, C. T. Hagberg.** NICHOLAS FABRI DE PEIRESC (1580-1637) x + 56 p. For presentation to the members of the Roxburghe Club. London, 1927. ISIS

XVIIIth Century (second half).

A. — Mathematics.

- Brodetsky, Selig.** SIR ISAAC NEWTON : a brief account of his life and work. XII + 161 p. London, METHUEN, 1927. ISIS

- Ferrari, G. M.** IL LEIBNIZ giudicato dal VICO. *L'arduo*, I, 134-140, 1921. ISIS

- Greenstreet, W. J.** ISAAC NEWTON, 1642-1727. A memorial volume edited for the Mathematical Association. VIII + 181 p., 9 pl. London, BELL, 1927. ISIS

- Hoppe, Edmund.** Die Entdeckung der partiellen Differentialgleichungen. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 158-165, 1927. ISIS

„ Es zeigt sich also, dass die Erfindung und Entwicklung partieller Differentialgleichungen weder mit der Newtonschen Fluxionsrechnung noch mit seiner Mechanik in gar keinen Zusammenhang weder historisch noch inhaltlich steht, sondern rein mathematisch entstanden und wesentlich durch geometrische Anwendungen entwickelt ist. Wenn dieselben auf physikalische Fragen angewandt wurden, waren es HUYGENS Lichttheorie oder solche Probleme der Mechanik, mit welchen sich NEWTON nicht beschäftigt hatte. Gerade in der ersten Zeit der Erfindung und Anwendung der partiellen Differentialgleichungen lehnte NEWTON diese Methode entschieden ab und sprach ihr gar keine Bedeutung zu. „

- (Newton) **Belopol'skii, A. A.** The bicentenary of the death of ISAAC NEWTON. *Leningrad Akad. Sci. S. S. S. R. Notes for a History of Science*, I : 3-10, 2 portraits, 1927.

- Krylov, A. N.** NEWTON's sources. *Ibid.* I : 11-45, 1927.

- Lazarev, P. P.** NEWTON's works on optics. *Ibid.* I : 46-53. (in Russian) 1927. C. W. D. ISIS

- Picard, Emile.** Le deuxième centenaire de la mort de NEWTON. *Rev. de France*, 753-761, 15 avril, 1927. ISIS

- Weis, Friedrich.** Oratio de Historia cycloidis. Ein Beitrag zur Behandlung des Streites, der sich an die Erfindung der Cycloide knüpft. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 345-355, 1927. ISIS

This hitherto unpublished lecture on the history of the cycloid was delivered

by JAMES BERNQUILLI (1654-1705) in 1701 when he assumed for the third time the philosophical decanate in the University of Basel. G. S.

Wieleitner, Heinrich. ISAAC NEWTON. Zu seinem 200 jährigen Todestage, *Unterrichtsblätter für Mathematik und Naturwissenschaften*, 33, p. 103-107, 1927. ISIS

B. — *Physical Sciences and Technology.*

Hoppe, Edmund. OTTO VON GUERICKE. x + 66 p., 10 fig. Berlin, OTTO SALLE, 1927. ISIS

Middleton, William S. The medical aspect of ROBERT HOOKE. *Annals of Medical History*, 9, 227-243, 1927. ISIS

Mouy, P. Les lois du choc des corps d'après MALEBRANCHE. 94 p., Paris, J. VRIN, 1927. ISIS

Après un rappel des lois du choc chez DESCARTES et LEIBNIZ, l'auteur examine les trois formes qu'à prises chez MALEBRANCHE la loi du choc des corps : 1) dans les quatre premières éditions de la Recherche de la vérité (1675-1688), ch. IX de la 2^e p. du livre IV : règles de la communication des mouvements; 2) Des lois de la communication des mouvements, 1692; 3) lettre à LEIBNIZ du 13 décembre 1698. Ces changements ont été déterminés par l'influence de MARIOTTE et de LEIBNIZ. L. G.

C. — *Natural Sciences.*

Cardini, Massimiliano. Gli albori della biologia moderna. FRANCESCO REDI (1626-1697). *Scientia*, 41, 25-34, 1927. Traduct. franç., suppl., 23-34. ISIS

Swammerdam, Jan (1637-80). Tractatus physico-anatomico-medicus de respiratione usque pulmonum. In quo praeter primam respirationis in foetu inchoationem, aëris per circulum propulsio statuminaur, attractio exploditur; experimentaque ad explicandum sanguinis in corde tam auctum quam diminutum motum in medium producuntur. Leiden, 1667. *Opuscula selecta Neerlandicorum de arte medica*. Fasciculus sextus quem curatores miscellaneorum quae vocantur *Nederlandsch Tijdschrift voor Geneeskunde* collegerunt et ediderunt. p. 46-181, Amsterdam, 1927. ISIS

Reprint of the original edition of Leiden 1667, with Dutch translation. SWAMMERDAM is better known as one of the early students of minute anatomy, embryology and zoology, but he was also a very remarkable physiologist. The work here reprinted is a splendid study of the mechanical part of respiration. BORELLI is often quoted as being the first to make an experimental study of this, but the second part of his *De motu animalium* was published only fourteen years after SWAMMERDAM's treatise (Rome 1681). In the course

of this investigation, SWAMMERDAM discovered the essential difference in the lungs of the foetus before and after birth, this being of great medico-legal importance (see p. 118). G. S.

D. — *Medical Sciences.*

Calamida, U. Tavole anatomiche volanti a piani sovrapposti del Secolo XVII. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925). Siena, p. 133-139, 1926. ISIS

Three anatomical tables dated Milano, 1663; Milano, 1666; Roma, 1687. G. S.

Graaf, Regner de (1641-73). Tractatus anatomico-medicus de succi pancreatici natura et usu. *Opuscula selecta Neerlandicorum de arte medica*. Fasciculus sextus quem curatores miscellaneorum quae vocantur *Nederlandsch Tijdschrift voor Geneeskunde* collegerunt et ediderunt, p. 182-293, Amsterdam, 1927. ISIS

Reprint of chapters 1 to 7 (out of 11) of this great classic, with Dutch translation and portrait. It was first printed as a thesis in Leiden in 1664. The present edition is made after the edition of Leiden 1671; the translation being a reprint of the text published in Amsterdam 1686. It is hardly necessary to emphasize the importance of this treatise, one the most important in the history of physiology. G. S.

(Niesius, Benjamin). Inaugural medical debate on elephantiasis or lepra arabum by BENJAMIN NIESIUS, University of Strassbourg, July 1673. Translated from the original Latin by CHAPLAIN BENEDICT STETTER. Preface by O. E. DENNEY. *Annals of Medical History*, 9, 267-276, 1927. ISIS

Piccinini, Prassitele. Il concetto Lancisiano degli studii medici. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925). Siena, p. 29-30, 1926. ISIS

Apropos of the *De recta studiorum medicorum ratione instituenda* of GIOV. MARIA LANCISI (1654-1720), 1715. G. S.

Robinson, Herbert Spencer. The Harveian Orators. From EDMUND WILSON to the orator of the plague year. *Medical Life*, 34, 316-354, 2 pl., 4 portraits, 1927. ISIS

Sylvius, Franciscus de le Boë (1614-72). Oratio inauguralis de hominis cognitione, Leiden 1658. *Opuscula selecta Neerlandicorum de arte medica*. Fasciculus sextus quem curatores miscellaneorum quae vocantur *Nederlandsch Tijdschrift voor Geneeskunde* collegerunt et ediderunt. p. 1-45, Amsterdam, 1927. ISIS

Lecture delivered by SYLVIVS on Sept. 17, 1658, to inaugurate his professorship of medical practice in the Leiden University; it is a sort of philosophical introduction to his course. Latin text with Dutch translation. G. S.

E. — *Alia.*

Boutroux, Emile. Les vérités éternelles chez DESCARTES. *Thèse latine* traduite par M. CANGUILHEM. Préface de LÉON BRUNSCHVIG. 146 p. *Bibl. de philos. contempor.*, F. ALCAN, Paris, 1926. ISIS

« Si le XIX^e s. a été, comme le disait BOUTROUX, le siècle des cloisons étanches, si une division paradoxale du travail y a maintenu les philosophes dans le monde des généralités, à l'écart du travail positif du savant et des historiens, ce sont les deux thèses de 1874 (Les vérités éternelles chez DESCARTES; et, De la contingence des lois de la nature) qui devaient faire tomber les concepts à priori d'un positivisme illusoire et d'un empirisme systématique. La méditation de l'œuvre que nous publions est donc importante, non seulement parce qu'elle fait connaître de la pensée cartésienne, mais aussi parce qu'elle a marqué le point de départ pour la rénovation de l'histoire de la philosophie » Ces premières lignes de la préface de BRUNSCHVIG sont suivies de l'étude qu'il écrivit au lendemain de la mort de BOUTROUX pour la *Revue de Métaphysique et de morale* (29, 261-84, 1922; *Isis*, 6, 462), puis de la traduction de la thèse de BOUTROUX. L. G.

Rand, Benjamin (editor). The correspondence of JOHN LOCKE and EDWARD CLARKE. With a biographical study. Oxford, University Press, 1927. ISIS

Sinistrari, Ludovico Maria (Friar Minor, 1622-1701). Demoniality. Translated into English from the Latin with introduction and notes, by MONTAGUE SUMMERS. XLIII + 127 p. London, Fortune Press, 1927. ISIS

Wolf, Abraham. The oldest biography of SPINOZA. Edited with translation, introduction, annotations, etc. 196 p., 6 pl. London, GEORGE ALLEN and UNWIN, 1927. ISIS

« This biography is the oldest, and it is the only one written by one who knew SPINOZA personally, and loved him well, if not always wisely. It is obviously high time for a really reliable edition of it to be readily accessible. But in order to be of service to the wider English reading public I have also added a translation, an introduction, and annotations, and some of the most important additional biographical matter which was written before the better known but less valuable Life by COLER'S (1705). »

XVIIIth Century (whole and first half).

A. — *Mathematics.*

Brennecke, Rudolf. Die Verdienste LEONHARD EÜLERS um den Potentialbegriff. *Zeitschrift für Physik*, 25, 42-45, 1924. ISIS

- Euler, Leonhard.** Opera omnia. Series 1, vol. 15 : Commentationes analyticae ad theoriâ serierum infinitarum pertinentes. Volumen secundum. Edited by G. FABER. x + 722 p. Leipzig, B. G. TEUBNER, 1927. ISIS

B. — *Physical Sciences and Technology.*

- Hertzberger, Menno.** Short-title catalogue of books written and edited by HERMAN BOERHAAVE, compiled with the assistance of E. J. VAN DER LINDEN. Preface by J. G. DE LINT. Amsterdam, HERTZBERGER, 1927. ISIS

- Kalkschmidt, Eugen.** Die Goldmacher JOH. FRIEDR. BÖTTGER und die Erfindung des europäischen Porzellans. 15. Aufl. 80 S. Stuttgart, DIECK and Co., 1926. ISIS

C. — *Natural Sciences.*

- Clark-Kennedy, A. E.** STEPHEN HALES : physiologist and botanist, 1677-1761. *Nature*, 120, 228-231, 1927. ISIS

Address delivered at Corpus Christi College, Cambridge, on June 16, 1927.

- Steiger, Rudolf.** JOHANN JAKOB SCHEUCHZER (1672-1733). 1. Werdenzeit (bis 1699). (*Schweizer Studien zur Geschichtswissenschaft*, Bd. 15, Heft 1). 151 p. Zürich, Gebr. LEEMANN, 1927. ISIS

This is the first instalment of a biography of the great Swiss naturalist, SCHEUCHZER, the founder of the physical geography of high altitudes and one of the founders of palaeontology. It deals only with the years of childhood and youth, but is based largely upon unpublished documents. Let us hope that the author will soon complete a task so well begun. G. S.

D. — *Medical Sciences.*

- Calamida, U.** Di un carteggio inedito di GIUSEPPE ZAMBECCARI, 1681-1729. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, p. 120-127, 1926. ISIS

- Caullery, Maurice.** L'histoire des fourmis de RÉAUMUR. *Revue scientifique*, 12 févr. 1927. ISIS

*A propos du mémoire publié par W. M. WHEELER (*Isis*, 9, 445-7).

- Chiadini, Massimo.** Terza serie di carteggi inediti del MORGAGNI. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925) Siena, p. 146-153, 1926. ISIS

Franco, Enrico Emilio. Un anatomico italiano professore a Lisbona nel secolo XVIII. BERNARDO SANTUCCI da Cortona, 1701-1764. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, p. 91-96, 1926. ISIS

Lang, August. Medizinische Gerichtsbarkeit im alten Zürich (1714-1738). (*Zürcher Medizingeschichtliche Abhandlungen* hrsg. von G. A. WEHRLI, 5) 64 S. Zürich, ORELL FÜSSLI, 1925. ISIS

E. — *Alia*.

Taylor, A. E. DAVID HUME and the miraculous. (The Leslie Stephen Lecture, 1927) 54 p. Cambridge, University Press, 1927. ISIS

XVIIIth Century (second half).

B. — *Physical sciences and Technology*.

Furlani, Giacomo. L'Opera di ALESSANDRO VOLTA nell'invenzione e nello studio della pila. *Periodico di Matematiche*, 7, 154-186, 1927. ISIS

Hahn, Paul. GEORG CHRISTOPH LICHTENBERG und die exakten Wissenschaften. Materialien zu seiner Biographie. 87 p. Göttingen, VANDENHOECK und RUPRECHT, 1927. ISIS

Hellmann, Gustav. Zur Geschichte der Wettervorhersage in Kalendern. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 291-293, 1927. ISIS

The calendar published officially since 1700 by the Preussische Sozietät der Wissenschaften (which became later the Prussian Academy) contained like all contemporary almanacs, weather prognostications. These were suppressed in 1779, probably at the initiative of LAMBERT and BEGUELIN, with the result that the calendar was boycotted by the farmers. The Academy was actually obliged, for commercial reasons, to reestablish the prognostications in 1780, and these continued until 1804. This experience was not a new one: in 1700, STURM, professor at Altdorf and, in the forties, ANDREAS MAYER, professor at Greifswald, had learned at their expense that it did not pay to publish almanacs without weather prophecies. G. S.

Hoffmann, Paul. ACHIM VON ARNIM über JOHANN WILHELM RITTER. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 357-362, 1927. ISIS

Lippmann, Edmund O. von. Ein Bildnis J. R. SPIELMANN's. *Chemiker-Zeitung*, Nr. 38, 1927. ISIS

JACOB REINHOLD SPIELMANN was GOETHE's instructor in chemistry.

Mieli, Aldo. ALESSANDRO VOLTA. (Profili). 87 p. Roma, FORMIGGINI, 1927. ISIS

Patterson, T. S. Soda, NICOLAS LEBLANC, and the French Revolution *Proceedings of the Royal Philosophical Society of Glasgow*, 53, 113-128, 1925. ISIS

A good account of LEBLANC's invention and of his tragic life, ended by suicide in 1806. G. S.

Przibram, Karl. LICHTENBERG als Physiker (150 Jahre LICHTENBERG-sche Figuren). *Die Naturwissenschaften*, 423-425, 1927. ISIS

Winderlich, Rudolf. Geschichtliche Notiz zur Verflüssigung der Gase. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 356, 1927. ISIS

Apropos of the experiments recorded by CHRISTOPH GIRTANNER in his *Anfangsgründe der antiphlogistischen Chemie* (Berlin 1792). G. S.

C. — *Natural Sciences.*

Chiadini, Massimo. Il naturalista forlivese FRANCESCO ANTONIO MAIOLI (1746-1823). Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, p. 153-157, 1926. ISIS

Febvre, Lucien. Un chapitre d'histoire de l'esprit humain. Les sciences naturelles de LINNÉ à LAMARCK et à GEORGES CUVIER. *Revue de Synthèse historique*, 43, 37-60, 1927. ISIS

Apropos of HENRI DAUDIN's *Etudes d'histoire des sciences naturelles* (2 vols., Paris, 1926) (*Isis*, 10, 502-505).

Gradenigo, Giuseppe. Sulle comunicazioni esistenti tra i canali semi-circolari degli uccelli. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, p. 139-145, 1926. ISIS

Apropos of ANTONIO SCARPA, *De structura fenestrae rotundae auris et de tympano secundario, anatomicae observationes*, Modena, 1772. SCARPA discovered the communications existing between the semi-circular canals of birds. G. S.

MacDonald, John. Travels in various parts of Europe, Asia, and Africa, 1745-1779. With introductions by JOHN BERESFORD. XXIV + 256 p., 7 pl. (Broadway Travellers' Series.) London, 1927. ISIS

'The first edition of this work was printed at London, 1790, for the author "a cadet of the family of KEPOCH in Inverness-shire, who after the ruin of his family in 1745, was thrown when a child upon the wide world".'

- Manquat, M.** Les opinions de GUENAU (1768), naturaliste, sur la génération spontanée et la variabilité des espèces. *Rev. des quest. scientif.*, 11, 70-87, 1927. ISIS

L'auteur voit en PHILIBERT GUENAU DE MONTBÉLIARD (Semur, 1720; id., 1785, 11, 28), collaborateur de BUFFON pour les premiers volumes de son Histoire naturelle, collaborateur à l'Encyclopédie en ce qui touche aux insectes, et auteur entre autres d'une « Histoire naturelle séparée contenant les observations de J. SWAMMERDAM sur les insectes, avec des notes et trente-six planches en taille-douce » (2 vol. 1768), le véritable précurseur de l'évolutionnisme. Passant en revue les textes *attribués* à THALÈS, ANAXIMANDRE, etc., ceux de LUCILIO VANINI, de BENOIT DE MAILLET, il les trouve vides au point de vue du transformisme et conclut que celui-ci date du milieu du XVIII^e siècle. GUENAU est partisan de la génération spontanée. L. G.

- Molinéry, Raymond.** A propos du Traité sur les propriétés et les effets du café de M. B. MOSELEY (1786). *Bulletin la Soc. Fr. hist. Méd.*, 21, 90-96, 1927. ISIS

- Woollacott, Arthur P.** MACKENZIE and his voyageurs. By canoe to the Arctic and the Pacific, 1789-93. London, DENT, 1927. ISIS

D. — Medical Sciences.

- Adami, J. George.** CHARLES WHITE of Manchester (1728-1813) and the Arrest of puerperal fever, with which are reprinted CHARLES WHITE's published writings upon puerperal fever. 142 p. New York, PAUL B. HOEBER, 1923. ISIS

CHARLES WHITE was a distinguished surgeon, having studied under JOHN HUNTER, and was the first to excise the head of the humerus for caries, in place of amputation. He also employed dried sponge to arrest haemorrhage before anyone else in England, and has been called the « Father of Anthropometry. » His « Treatise on the Management of Pregnant and Lying-in Women » appeared in 1773, and was the first publication to insist on absolute cleanliness around a patient in the effort to prevent puerperal infection. Contains good discussion of historical opinions about puerperal fever, with commentary on the ideas of SEMMELWEIS. No index. C. D. L.

- Barbosa Sueiro, M. B.** MANUEL CONSTÂNCIO, a sua vida e a sua obra. *Arq. de anatomia e antropologia*, 9, 741-771, 1924-26. ISIS

MANUEL CONSTANCIO (1726,04,04 — 1817,07,14) anatomiste et chirurgien portugais. L. G.

- Feis, Oswald.** 'Nachgelassenes Gebet JOHANN CHRISTIAN SENCKENBERGS. *Archiv für Geschichte der Medizin*, 19, 297-299, 1927. ISIS

- Feis, Oswald.** Verhandlung über einen Fall sexueller Perversion aus dem Jahre 1776. *Archiv für Geschichte der Medizin*, 19, 293-297, 1927. ISIS

Gilbert, A. et Cornet, P. GUYTON DE MORVEAU et les « fumigations guytoniennes ». *Paris médical*, 26 juin 1926, I-IV. ISIS

Ces « fumigations » ont vu le jour en 1773, à la suite d'une épidémie de « fièvre infectieuse » causée par l'exhumation de cadavres que le gel terrible de l'hiver n'avait pas permis d'enfouir convenablement, à Dijon, la ville natale de GUYTON. L'épidémie fut arrêtée par des fumigations d'acide marin déphlogistiqué (chlore). L. G.

Pasinetti, Carlo. La legislazione antitubercolare della Repubblica di Venezia (1772-73-74) e sue vicende sotto i successivi governi. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, p. 96-115, 1926. ISIS

Variot, G. L'anatomiste PIERRE CAMPER et sa doctrine sur l'éducation physique des enfants. Une aberration de J. J. ROUSSEAU. *Bull. la Soc. fr. hist. méd.*, 21, 134-145, 1927. ISIS

E. — *Alia.*

Arnhold, Erna. GOETHE'S Berliner Beziehungen. VIII + 456 p. Gotha, LEOPOLD KLOTZ, 1925. ISIS

Reviewed by FELIX HASSELBERG in *Deutsche Literaturzeitung*, 705-709, 1927.

Barthel, Ernst. Die Gegenwartsbedeutung der Goetheschen Farbenlehre. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 363-365, 1927. ISIS

Bentham, Jeremy. Plan for an universal and perpetual peace. With an introduction by C. JOHN COLOMBOS. 44 p. London, SWEET and MAXWELL, 1927. ISIS

Bouvier, Auguste. JOHANN GEORG ZIMMERMANN 1728-1795. Un représentant suisse du cosmopolitisme littéraire au XVIII^e siècle. VIII + 209 p. Genève, GEORG, 1925. ISIS

Reviewed by CHR. JANENTZKY, *Deutsche Literaturzeitung*, 2138-2141, 1926.

Delekat, Friedrich. JOHANN HEINRICH PESTALOZZI, der Mensch und der Philosoph. (*Diss.*) 48 p. Leipzig, QUELLE and MEYER, 1926. ISIS

Griffith, Grosvenor Talbot. Population problems of the age of MALTHUS. 276 p., diagrams. Cambridge, University Press, 1926. ISIS

Newman, Bertram. EDMUND BURKE. Portrait. London, BELL, 1927. ISIS

Rousseau, Jean Jacques. Correspondance générale de J. J. ROUSSEAU. Éditée par THÉOPHILE DUFOUR. Vol. IV. Paris, COLIN, 1927. ISIS

Schuster, Julius. Wege zu GOETHES Naturwissenschaft. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 365-366, 1927. ISIS

Souriau, Michel. Le jugement réfléchissant dans la philosophie de KANT. XII + 142 p. *Bibl. de philos. contempor.*, ALCAN, Paris, 1926. ISIS

Étude d'ensemble de la doctrine du jugement réfléchissant, doctrine qui forme le centre de la Critique du jugement. L'auteur suit l'évolution de la pensée de KANT à partir de la Critique de la raison pure (1781) où la faculté de juger est pour la première fois étudiée systématiquement et où l'on peut trouver le germe du jugement réfléchissant (1er chap.); il recherche (chap. 2) les sources historiques de l'esthétique et de la théologie de KANT, et étudiant la composition de la Critique du jugement, il situe la découverte de la faculté de juger réfléchissante entre mars 1788 et mai 1789; le dernier chap. est consacré à l'étude du jugement réfléchissant dans la Critique du jugement (1790). L. G.

XIXth Century (whole and first half).

A. — Mathematics.

(**Gauss, Carl Friedrich**). Briefwechsel zwischen CARL FRIEDRICH GAUSS und CHRISTIAN LUDWIG GERLING. Herausgeg. im Auftrage der Ges. z. Beförderung der gesamten Naturwissenschaften zu Marburg von CLEMENS SCHAEFER. XX + 820 p., portrait and facsimile. Berlin, OTTO ELSNER, 1927. ISIS

GERLING war zuerst Schüler von GAUSS und wurde mit der Zeit immer mehr mit ihm befreundet. Er war zuerst Lehrer am Lyzeum in Cassel, dann (1817-1864) Prof. für Physik, Mathematik und Astronomie an der Universität Marburg. Er setzte in Marburg die Errichtung eines Institutes für Physik (und Astronomie) durch, das 1841 etwas Ausserordentliches war. Ausserdem hat er sich durch die Vermessung von Kurhessen einen Namen gemacht. Von dieser Vermessung und von geodätischen Angelegenheiten handelt dieser Briefwechsel zu allermeist. Er schlieszt sich würdig an die Briefwechsel GAUSS-SCHUMACHER, GAUSS-OLBERS und GAUSS-BESSEL an, die bisher veröffentlicht wurden. Neben den Vermessungsangelegenheiten werden viele andere wissenschaftliche und technische Fragen berührt, wobei die grosse Ueberlegenheit von GAUSS in helles Licht tritt. Im Menschlichen wendet sich aber GAUSS vielfach an GERLING um Rat. Den noch kleinen Zeitverhältnissen steht die hohe Wissenschaftlichkeit der Gelehrten imponierend gegenüber. Ein sehr guter Index erleichtert die Benützung. H. W.

Lorey, Wilhelm. AUGUST LEOPOLD CRELLE zum Gedächtnis. *J. f. reine und angewandte Mathematik*, 157, 3-11, 1926. ISIS

Mack, Heinrich. C. F. GAUSZ und die Seinen. Festschrift zu seinem. 150. Geburtstage. XII + 130 + (20) p., 11 pl. (Werkstücke aus Museum, Archiv und Bibliothek der Stadt Braunschweig, II). Braunschweig, E. APPELHANS & Co., 1927. ISIS

Diese Schrift bildet eine vortreffliche Ergänzung des eben besprochenen Briefwechsels. Sie enthält nämlich lauter Familienbriefe mit zahlreichen Anmerkungen, ausgezeichnete Nachfahrentafeln und Familienbilder. H. W.

Müller, Franz Joh. Der Geodät JOH. LEONHARD SPÄTH aus Augsburg (1759 bis 1842). Der erste Mathematikprofessor der Münchener Universität. Ein nachträglicher Beitrag zum Münchener Universitätsjubiläum vom November 1926. *Bayer. Zeitschr. f. Vermessungswesen*, 26, 59-75, 1927. ISIS

Speiser, Andreas. Naturphilosophische Untersuchungen von EULER und RIEMANN. *J. f. reine und angewandte Mathematik*, 157, 105-114, 1926. ISIS

Stanford, Alfred. Navigator. The story of NATHANIEL BOWDITCH. XII + 308 p., portrait. New York, WILLIAM MORROW, 1927. ISIS

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his time), and several of them contain a summary of the work done since CASTRÉN's day. R. P. BLAKE.

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SCHROEDER VAN DER KOLK was the reformer of the treatment of the insane in the Netherlands. He well knew the cruelty of the old treatment. When he had been appointed at the University of Utrecht he had witnessed the atrocious spectacle of an insane asylum being used as a place of public amusement. The address here reprinted was his reaction, a generous plea for the most unfortunate of our fellow men. In this respect he was a pioneer, if not in the world, at least in his own country. G. S.

Weve, H. J. M. Korte mededeeling betreffende een verdichte brillengeschiedenis. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 405-407, 1927. ISIS

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ISIS

L'auteur a consacré une bonne partie de sa vie à l'étude de FICHTE. Dès 1902 il publiait « La Philosophie de FICHTE » (ALCAN); en 1922 il commençait la publication de l'ouvrage monumental dont voici le troisième volume. Le premier a été longuement analysé dans *Isis*, 4, 514-515; le deuxième parut en 1924 (*Isis*, 7, 246). La troisième partie étudie avec la même rigueur, et la même abondance d'informations, les dernières années de sa vie à Berlin : La lutte pour l'affranchissement national (1806-13) : 1. La guerre contre la France; 2. Les discours à la Nation allemande; 3. La fondation de l'Université de Berlin; 4. Les cours de 1810-1811; 5. Le rectorat de FICHTE; 6. Les cours de 1812-1813, 7. La guerre de 1813. La thèse principale de l'auteur c'est qu'il n'y a pas de « seconde philosophie » de FICHTE. « Les derniers ouvrages de FICHTE ne sont qu'un long effort pour maintenir, tout en parlant

le langage de la ' Philosophie de la Nature, ' le principe original de sa philosophie ' critique '. FICHTE est resté le disciple de la Révolution française; ce n'est pas lui qui en a renié les principes, mais NAPOLÉON. G. S.

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Professor LORIA was born at Mantua in 1862, received his doctorate at Turin in 1883 and since 1886 has been professor of higher geometry at the University of Genoa. He has been very active in publishing results of his researches, often in popular form, in the history of mathematics and in various parts of pure mathematics. There are more than 250 main titles in the list of his writings 1881-1926, and these include works to be found in every mathematical library of importance. His periodical *Bollettino di Bibliografia e Storia della Scienze Matematiche*, of which the first volume appeared in 1898, has been continued since 1922 as a *Sezione Storico-bibliografica* of *Il Bollettino di Matematica*. We felicitate Professor LORIA, distinguished and genial scholar, on the recognition of his notable achievements. R. C. A.

B. — Physical Sciences and Technology.

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F.Z. ROUSSIN (1827.09.06 — 1894.04.08) pharmacien militaire, chimiste, toxicologue, auteur de la découverte des composés azoïques. L. G.

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Emin Pasha (Eduard Schnitzer, 1840-92). Die Tagebücher von EMIN PASCHA. Band 4, VI + 448 p. Braunschweig, GEORG WESTERMANN, 1927. ISIS

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Genevois, L. CHARLES HENRY et l'application des mathématiques à la biologie. *Rev. scientifique*, 97-100, portr., 26 févr. 1927. ISIS

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F. P. FOSTER (1841-1911) was the author of the most scholarly medical dictionary of American origin (1888-93) and, for some time, editor of the *New York Medical Journal*. Biography with autograph and many portraits. G. S.

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Anatomiste portugais (1835, 12, 05 — 1899, 04, 29),

Hemmeter, John C. HEMMETER Festschrift number of *Medical Life*. *Medical Life*, 34, 154-254, April 1927. ISIS

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(**Lister, Joseph**). JOSEPH, BARON LISTER : centenary volume, 1827-1927. Edited for the Lister Centenary Committee of the British Medical Association by A. LOGAN-TURNER. xv + 182 p., 9 pl. Edinburgh, OLIVER and BOYD, 1927. ISIS

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Anatomiste, physiologiste et médecin belge, né à Créteil, France, en 1839, décédé à Liège, en 1914.

(**Osler, Sir William**). Sir WILLIAM OSLER Memorial Number : *Bulletin* no. IX of the *International Association of Medical Museums and Journal of Technical Methods*. Privately issued at 836 University St., Montreal, Canada, Foreword, xi pages, by WILLIAM H. WELCH. Proem, p. XIII — XVIII, by Sir CLIFFORD ALLBUTT. Editorial preface, p. XIX — XXII by MAUDE E. ABBOTT. 632 p., 1926. ISIS

Beautiful series of appreciations and reminiscences classified into editorials,

general articles, biographical, in memoriam, and bibliographical. The international scope of the tribute is shown by a list of the contributors, some of whom are Sir ARTHUR KEITH, PIERRE MARIE, ETTORE MARCHIAFAVA, KARI. SUDHOFF, FIELDING H. GARRISON, WU LIEN-TEH, and F. J. SHEPHERD. There is included a bibliography of OSLER's writings taking up 130 pages. The volume is handsomely illustrated, and with HARVEY CUSHING's monumental biography, (*Isis*, 8, 358) should prove a valuable source-book. No index. C. D. L.

Riddell, Lord. Dame LOUISA ALDRICH-BLAKE (d. 1925, Ae 60). 91 p. London, HODDER and STOUGHTON, 1927. ISIS

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Sherrington, Sir C. S. LISTER and Physiology. *Nature*, 119, 606-608, 1927. ISIS

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Notice biographique, bibliographique et critique sur J. A. SERRANO (1851. 10, 01 — 1904, 12, 07) professeur d'anatomie et de chirurgie à Lisbonne; plusieurs portraits. Dans le même fasc., VILHENA publie également quelques lettres de SERRANO (p. 579-634) et donne (489-578) le sommaire du cours d'angéiologie professé par SERRANO, d'après un exemplaire corrigé de sa main de son « Manual synoptico de anatomia descriptiva ». L. G.

E. — *Alia*.

Andler, Charles. Quelques sources de la philosophie intellectualiste de NIETSCHE (1876-81). *R. d'hist. de la philosophie*, 1, 69-102, 1927. ISIS

Horwitz, Hugo Th. Aus HERBERT SPENCERS Ingenieurzeit. *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 170-90, 1927. ISIS

Mouy, P. L'idée de progrès dans la philosophie de RENOUVIER. *Thèse* Paris, 208 p. *Bibl. d'hist. de la philosophie*, J. VRIN, Paris, 1927. ISIS

En fait, cette thèse est un examen de la philosophie du progrès à travers tout le XIX^e siècle. Autour de la revue des opinions successives de **RENOUVIER** sur le progrès (sa foi dans le progrès dans le *Manuel de philosophie moderne* 1842; le recul qui se marque à ce point de vue dans le *Manuel de philosophie ancienne*, 1844; la critique de la philosophie du progrès : *Deuxième essai de critique générale*, 1859, *Science et morale*, 1869, articles de *La Critique philosophique*, 1875, 1880-83) et de l'examen critique de la valeur de l'idée de progrès, se groupe l'exposé, d'ailleurs fragmentaire et dispersé, des idées de **SAINT-SIMON** et des saint-simoniens, de **FOURIER**, de **PROUDHON**, **AUG. COMTE**, **SPENCER**.

L. G.

Shurlock, Fredk. W. **HERBERT SPENCER's electrical apparatus.** *Nature*, 119, 672, 1927. ISIS

A note on this apparatus owned and made by **WILLIAM GEORGE SPENCER**, **HERBERT's** father, and by **HERBERT** himself. It is now the property of **COLIN HYDE BENNETT** in **DERBY**, England. G. S.

Sly, John F. The genesis of the universal postal union. A study in the beginnings of international organization. *International Conciliation*, No. 233, p. 393-444, New York, October, 1927. ISIS

XXth Century.

B. — *Physical Sciences and Technology.*

Addison, Col. G. H. (editor). The work of the Royal Engineers in the European War, 1914-1918. (Published by the Secretary, Institution of Royal Engineers, Chatham). Miscellaneous; the organization and expansion of the Corps, 1914-18; organization of engineer intelligence and information; camouflage service; concrete defence works and factories; forward communications; machinery, workshops and electricity; anti-aircraft searchlights; inundations; schools. III + 372 p. 100 pl. Chatham, W. and J. **MACKAY**, 1927. ISIS

Amundsen, Roald, and Lincoln Ellsworth. The first flight across the Polar Sea. With additional chapters by **JOH. HÖVER**, **Hj. RÜSER-LARSEN**, **GUSTAV AMUNDSEN**, **FINN MALMGREN** and **B. L. GOTTWALDT**. 274 p. London, **HUTCHINSON and Co.**, 1927. ISIS

Armstrong, Henry E. **RICHARD WILLSTÄTTER.** (Scientific Worthies, 45). *Nature*, 120, 1-5, 1927. ISIS

Chwolson, Orest Danilovič. Die Physik 1914-1926. 17 ausgew. Kapitel. Uebersetzt von **GEORG KLUGE**. IX + 696 p. Braunschweig, **VIEWEG**, 1927. ISIS

Favaro, G. A. Un grande esempio di collaborazione scientifica : il

catalogo e la carta fotografica del cielo. *Scientia*, 41, 173-180, 1927
trad. franç., *id.*, suppl., 71-78. ISIS

Histoire du catalogue astrophotographique et de la carte photographique
du ciel; indications sommaires sur l'état actuel des travaux. L. G.

Flettner, Anton. Mein Weg zum Rotor. 123 S., 114 Abb. Leipzig,
KÖHLER und AMELANG, 1926. ISIS

Flettner, Anton. The story of the rotor. From the German « Mein
Weg zum Rotor », 110 p., 30 pl. London, CROSBY LOCKWOOD, 1927.
ISIS

Haber, Fritz. Aus Leben und Beruf. Aufsätze, Reden, Vorträge.
Mit einem Bildnis. VIII + 174 p. Berlin, SPRINGER, 1927. ISIS

Inhaltsverzeichnis: Zum 80. Geburtstage von CARL ENGLER (1922). —
Die deutsche Chemie in den letzten 10 Jahren (1923). — Festrede zum
50jährigen! Stiftungsfest des Akademisch-Literarischen Vereins in Breslau
(1924). — Über Wissenschaft und Leben (1924). — Japanische Eindrücke
(1924). — Ansprache an den japanischen Unterrichtsminister im Unter-
richtsministerium bei Übergabe einer Sammlung deutscher Bücher (1924).
— Wirtschaftlicher Zusammenhang zwischen Deutschland und Japan (1925).
— Wissenschaftspflege (1925). — Über den Stand der Frage nach der Um-
wandelbarkeit der chemischen Elemente (1926). — Über die Grenzgebiete
der Chemie (1926). — Ansprache bei der Eröffnung des Japaninstituts
(1926). — Über Staat und Wissenschaft (1927). — Anhang: Die Notgemein-
schaft der deutschen Wissenschaft (1921).

Millikan, Robert Andrews. Conceptions in physics changed in our
generation. *Scientia*, 41, 255-264; trad. franç., *id.*, suppl., 107-116.

Rumpler, Edmund. Technisches über das Trans-Ozeanflugzeug.
*Archiv für Geschichte der Mathematik, der Naturwissenschaften und
der Technik*, 10, 185-206, 9 Abb., 1927. ISIS

C. — *Natural Sciences.*

Akeley, Carl (1864-1926). Whole number of *Natural History* (vol. 27,
no. 2, 115-179, New York 1927) devoted to him. ISIS

Articles by many, speaking of him as conservationist, explorer, sculptor,
inventor, taxidermist. Abundant illustrations. G. S.

Marchal, E. Notice sur JEAN MASSART. Annuaire de l'Académie
Royale de Belgique, Bruxelles, 90 p., 1927. ISIS

• Botaniste belge, né à Etterbeek en 1865, décédé à Houx, Yvoir, en 1925.

Rasmussen, Knud Johan Victor. Across Arctic America; narrative
of the fifth Thule Expedition. xx + 388 p., plates, portr. and maps
London, PUTNAM, 1927. ISIS

An abridged translation of *Fra Grønland til Stillehavet*.

D. — *Medical Sciences*.

- Kraus, Richard.** Zehn Jahre Südamerika. Vorträge über Epidemiologie und Infektionskrankheiten der Menschen und Tiere. 182 S., 108 Abb. im Text. Jena, FISCHER, 1927. ISIS

E. — *Alia*.

- Defries, Amelia.** The interpreter (PATRICK) GEDDES : the man and his gospel. XIII + 334 p., 9 pl. London, ROUTLEDGE, 1927. ISIS

- Dwelshauvers, Georges.** FREUD et la psychanalyse. *Revue de philosophie*, 25, 7-23, 125-152, 1927. ISIS

Deux conférences données au cercle thomiste de la faculté de philosophie de l'Institut catholique de Paris.

- Lévy-Provençal, E.** HENRI BASSET. *Hespéris*, 6, 1-4, 1926. ISIS

HENRI BASSET (Lunéville, 1892, 11, 07 — Rabat, 1926, 04, 13), fondateur de la revue *Hespéris*, s'était consacré à l'archéologie et à l'ethnographie marocaines. L. G.

- Metz, André.** EMILE MEYERSON et la critique de la raison. *Revue de philosophie*, 27, 64-88, 1927. ISIS

- Mieli, Aldo.** Un viaggio in Germania. Impressioni ed appunti di uno storico della scienza. *Archivio di storia d. scienza*, 7, 342-81, 1926. ISIS

Souvenirs sur E. DARMSTAEDTER, H. WIELEITNER, S. PLACZEK, C. MATSCHOSS, F. M. FELDHAUS, H. HAUSTEIN, H. E. SIGERIST, K. SUDHOFF, E. O. VON LIPPMANN, GRAF K. VON KLINCKOWSTROEM, etc. Plusieurs portraits. L. G.

- Parodi, Dominique.** La philosophie contemporaine en France; essai de classification des doctrines. 3^e éd. revue et augmentée d'un appendice. VI + 537 p. Paris, FÉLIX ALCAN, 1925. ISIS

La première édition de l'ouvrage est de 1919 (*Isis*, 4, 421); l'appendice porte sur « la philosophie française de 1918 à 1925 ». Étude critique de R. LE SENNE in *Rev. de métaphys. et de morale*, 34, 81-114, 1927. L. G.

- Poggendorff, J. C.** Biographisch-literarisches Handwörterbuch für Mathematik, Astronomie, Physik, Chemie und verwandte Wissenschaftsgebiete. Band 5 : 1904-1922. Redigiert von P. WEINMEISTER. 1. und 2. Abteilung. 1423 p. Leipzig, Verlag Chemie, 1926. ISIS

PART II.

HISTORICAL CLASSIFICATION.

Including only the items which could not be included in Part I — the fundamental (centurial) classification. Hence a student of Muslim science, for example, should not peruse simply the notes collected below under the heading « Islam »; he should examine as well those included above under the headings VIIIth Century, VIIIth Century, etc.

CONTENTS :

- I. — *Antiquity* : 1. Antiquity (generalities) ; 2. Egypt ; 3. Babylonia and Assyria ; 4. Greece ; 5. Rome.
- II. — *Middle Ages* : 6. Middle Ages (generalities) ; 7. Byzantium.
- III. — *Oriental Science and Civilization* : 8. Asia (generalities; Western Asia ; Central Asia ; Eastern Asia) ; 9. India ; 10. China ; 11. Japan ; 12. Israel ; 13. Iran ; 14. Islam.

I. ANTIQUITY.

1. — ANTIQUITY (*generalities*).

Belitz, Wilhelm. Wiederkäuer und ihre Krankheiten im Altertum. (*Abhandlungen aus der Geschichte der Veterinärmedizin*, Heft 12). 128 p. Leipzig, RICHTER, 1927. ISIS

Casson, Stanley. Macedonia, Thrace, and Illyria : their relations to Greece from the earliest times down to the time of PHILIP SON OF AMYNTAS. XXI + 357 p., 106 figs., 19 maps. London, Oxford University Press, 1926. ISIS

Reviewed by A. B. W., *American Historical Review*, 32, p. 906, July, 1927.

Cumont, Franz. Fouilles de Doura-Europos, 1922-23 (Haut-Commissariat de la République Française en Syrie et au Liban : Service des Antiquités et des Beaux Arts, Bibliothèque Archéologique et Historique, tome IX). LXVII + 533 p., 124 pl. Paris, GEUTHNER, 1926. ISIS

Reviewed by M. ROSTOVITZEFF, *American Historical Review*, 32, 836-41, 1927.

Delehaye, Hippolyte. Sanctus, essai sur le culte des saints dans

l'antiquité. VIII ¹+ 265 p. Bruxelles, Société des Bollandistes, 1927.

ISIS

Reviewed by PATRICK J. HEALY, *American Historical Review*, 33, 173-4, 1927.

Garstang, J. The progress of Hittite studies. *Nature*, 119, 819-820, 860-62, 1927.

ISIS

Glover, Terrot Reaveley. Democracy in the Ancient World. Cambridge, University Press, 1927.

ISIS

Hahn, Eduard. Die Völker unter babylonischem Kultureinfluss. Auftreten des gehopften Bieres. (Bier und Bierbereitung bei den Völkern der Urzeit, II.) 102 p., illus. Berlin, 1927.

ISIS

Heiberg, J. L. Geisteskrankheiten im klassischen Altertum. Sonderdruck aus *Allg. Zeitschrift für Psychiatrie*, Bd. 86 44 p. Berlin und Leipzig, W. DE GRUYTER, 1927.

ISIS

Reviewed by KARL BIRNBAUM, *Deutsche Literaturzeitung*, 1576-78, 1927.

Jouguet, Pierre. L'Impérialisme macédonien et l'hellénisation de l'Orient. (*L'Évolution de l'humanité*, dirigée par HENRI BERR). xvi + 503 p., illus., maps. Paris, Renaissance du Livre, 1926.

ISIS

Reviewed by W. S. FERGUSON, *American Historical Review*, 33, 95-97, 1927.

Niclot, Vincent. Les vers intestinaux dans la littérature médicale antique. *Paris médical*, 2 avril 1927, 1-IX.

ISIS

Osten, H. H. von der. Explorations in Hittite Asia Minor. *Amer. Journ. Semitic Lang. and Lit.*, 43, 73-176, 1927.

ISIS

Asia Minor, including the land of the ancient Hittites, is part of an immense bridge which connects the territories of Far Eastern culture with those of the Mediterranean. A sketch of what is known of Hittite history here introduces an interesting description of an expedition of exploration in the Hittite region, which occupies the greater part of the paper. The story of the wanderings of the author and his companions is illustrated by a large number of reproductions from photographs.

J. S.

Osten, H. H. von der. The ancient settlement at Kürigin Kaleh in Asia Minor. *Amer. Journ. Semitic Lang. and Lit.*, 43, 288-94, 1927.

ISIS

The results of excavations at Kürigin Kaleh are described. It is concluded that the place, — a natural fortress, — is the site of an ancient settlement on the road which connected the ancient Ankuvah (Angora) with Hattushash (the capital of the great Hittite empire from about 1800 to about 1200 B. C.)

J. S.

Petrie, Sir W. M. Flinders. Ancient weights and measures : illustrated

by the Egyptian collection in University College, London. vi + 52 p., 54 pl. London, Department of Egyptology, University College, 1926.

ISIS

Rostovtzeff, M. I. The history of the ancient world. Volume I. The Orient and Greece. Translated from the Russian by J. D. DUFF. XXIII + 418 p. Oxford, Clarendon Press, 1926.

ISIS

Reviewed by A. T. OLMSTEAD, *American Historical Review*, 32, 831-835, 1927.

Schlachter, Alois. Der Globus : seine Entstehung und Verwendung in der Antike nach den literarischen Quellen und den Darstellungen in der Kunst herausgegeben von FRIEDRICH GISINGER. (*Stoicheia*, Band 8). VIII + 118 p., 4 plates. Leipzig, TEUBNER, 1927.

ISIS

Reviewed by E. ZINNER in *Deutsche Literaturzeitung*, 1078-1079, 1927.

Torrey, C. C. An inscription of ELIBA'AL, King of Byblos. *Journ. Amer. Or. Soc.*, 46, 237-240, 1926.

ISIS

Records the discovery of a third Phœnician inscription, at Byblos, of earlier date than either the Moabite Stone or the Kalamu monument. The new inscribed object is a small statue of the Egyptian king OSORKON I (924-895 B. C.) We now have from this ancient city three royal inscriptions containing the same peculiar alphabetic forms; but we are still a long way from finding the beginnings of the Phœnician alphabet.

J. S.

2. — EGYPT.

Budge, Sir E. A. Wallis. CLEOPATRA'S needles and other Egyptian obelisks; a series of descriptions of all the important inscribed obelisks, with hieroglyphic texts, translations, etc. XXII + 308 p., 17 pl., 22 illus. in text. London, Religious Tract Society, 1926.

ISIS

Carter, Howard. TUT-ENCH-AMUN. Ein ägyptisches Königsgrab. Entdeckt von Earl of CARNAVON und HOWARD CARTER. Bd II. Mit einem Beitrag : Zur Geschichte der ägyptischen Kunst von den Anfängen bis TUT-ENCH-AMUN von GEORG STEINDORFF. 303 p., 153 fig. Leipzig, F. A. BROCKHAUS, 1927.

ISIS

Reviewed by A. SCHARFF, *Deutsche Literaturzeitung*, 1761-65, 1927.

Edgerton, W. F. Ancient Egyptian steering gear. *Amer. Journ. Semitic Lang. and Lit.*, 43, 254-265, 1927.

ISIS

* Egyptian sailors very early learned to set aside one or more oars on every large ship for the purpose of steering; but the manner in which the early steering oars were used is not evident. The question is argued by the author; and the subsequent development of the tiller is traced down to the time of HERODOTUS, with illustrations from the carvings of the tombs.

J. S.

Erman, Adolf. The literature of the ancient Egyptians. Poems, narratives and manuals of instruction from the third and second millennia B. C. Translated into English by AYLWARD M. BLACKMAN. XVII + 318 p. London, METHUEN, 1927. ISIS

German edition Leipzig, 1923.

Garland, (Major) H. and Bannister, C. O. Ancient Egyptian metallurgy. XI + 214 p. London, CHARLES GRIFFIN, 1927. ISIS

Hurry, Jamieson B. IMHOTEP : the vizier and physician of King ZOSER and afterwards the Egyptian God of medicine. XVI + 118 p., 13 pl.. Oxford, University Press, 1926. ISIS

Reviewed by T. E. PEET, *Nature*, 120, 358-9, 1927.

Keimer, Ludwig. Von der Bedeutung der Naturwissenschaften für die Ägyptologie und umgekehrt. Dem grossen SCHWEINFURTH zum Gedächtnis. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 87-102, 7 Abb., 1927. ISIS

Meyerhof, Max. Eine 5000 Jahre alte wässerige Lösung. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 336-7, 1927. ISIS

Saline solution discovered by GEORGE REISNER in the tomb of HETEP-HERES, CHEOPS's mother (c. 3000 B. C.). This is the first time that water has been found in an Egyptian tomb. G. S.

Moret, Alexandre. La mise à mort du Dieu en Egypte. 59 p., 18 fig. Paris, P. GEUTHNER, 1927. (15 frs.) ISIS

Première conférence de la Fondation Frazer, Oxford, 1926. Les documents égyptiens confirment les hypothèses hardies formulées dans le *Rameau d'Or*. On trouve en effet en Egypte aussi bien que dans les pays explorés par Sir JAMES FRAZER des rites magiques pour régir les saisons et se procurer les deux choses fondamentales, nourriture et progéniture, et ces rites culminent dans le sacrifice d'un dieu, « the dying god ». G. S.

Neugebauer, O. Die Grundlagen der ägyptischen Bruchrechnung. VI + 45 p., 8 pl. Berlin, SPRINGER, 1926. ISIS

Reviewed by HEINRICH WIELEITNER, *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 233-237, 1927.

Petrie, Sir W. M. Flinders. Glass stamps and weights : illustrated from the Egyptian collection in University College, London. VI + 28 p., 26 pl. London, British School of Archaeology in Egypt, University College, 1926. ISIS

Rey, Abel. Nouveau coup d'œil sur la mathématique égyptienne. *Revue de Synthèse historique*, 43, 27-35, 1927. ISIS

Scharff, Alexander. Grundzüge der ägyptischen Vorgeschichte. 69 p., 1 map, 111 fig. on 16 pl. (*Morgenland, Darstellungen aus Geschichte und Kultur des alten Orients*. Heft 12.) Leipzig, HINRICHS, 1927. ISIS

3. — BABYLONIA and ASSYRIA.

Albright, W. F. Note on the topography of ancient Mesopotamia. *Journ. Amer. Or. Soc.*, 46, 220-230, 1926. ISIS

Supplements and corrects the author's « A Babylonian Geographical Treatise on SARGON of Akkad's Empire », in vol. 45 of the above journal (see *Isis*, 9, 546-7). The author conducted investigations in Mesopotamia in the autumn of 1925. The search for Mari, one of his principal objectives, was quite unsuccessful, and the mystery remains. The author speaks of the vast number of mounds in the E. Tigris country; this region played a very remarkable role in the third millennium, when it was rich and prosperous; but its civilization declined after that time, since barbarian invasions brought about a wholesale destruction of Mesopotamian towns during the first part of the second millennium. A full description of the investigations, which should be of great interest, is to appear in the *Annual of the American Schools of Oriental Research*. J. S.

Contenau, Georges. Les tablettes de Kerkouk et les origines de la civilisation assyrienne. Extrait de *Babyloniaca*, tome 9, fasc. 2-4, 140 p., many illustrations. Paris, GEUTHNER, 1926. (50 frs.) ISIS

Darmstaedter, Ernst. Assyrische chemisch-technische Vorschriften und ihre Erklärung. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 72-86, 3 Abb., 1927. ISIS

Apròpos of the texts published by H. ZIMMERN and independently by R. CAMPBELL THOMPSON (1925) (*Isis*, 9, 147) « Die Wiedergabe dieser Texte und ihre Deutung ist aber in beiden Ausgaben nicht ganz befriedigend, und es soll hier deshalb der Versuch gemacht werden, auf Grund der Arbeiten ZIMMERN'S und THOMPSON'S einen kombinierten neuen Text zu konstruieren, bei dem wir auch einige freundlich überlassene Bemerkungen von H. ZIMMERN verwerten. Wir versuchen dabei, nach ausführlicher Beschäftigung mit der Gesamtmaterie und mit Hilfe chemischer und technischer Überlegungen und Erfahrungen, ein etwas klareres Bild von dem technischen Wissen und Können der Babylonier und Assyrer zu geben, besonders auf dem Gebiete der Herstellung von Gläsern und Glasuren. »

Geers, F. W. A Babylonian omen text. *Amer. Journ. Semitic Lang. and Lit.*, 43, 22-41, 1926. ISIS

Assyro-Babylonian literature abounds in material relating to signs and portents, collected by a special class of priests, and classified and arranged systematically. Three classes of omens may be distinguished; those connected with and deduced from the observed consequences of every-day happenings (terrestrial, including historical, omens); those deduced from observations of the sky, constellations, eclipses, movements of the clouds, winds, etc.

(celestial omens) and a third group deduced from sacrificial animals (liver omens). A cuneiform tablet of the University of Chicago summarizes a number of terrestrial omens for the use of the incantation priest, from which predictions may be made about the course of a patient's ailment. The original is transcribed and a translation given. J. S.

Luckenbill, Daniel David. Ancient records of Assyria and Babylonia. 2 vols., XVI + 297 p.; XII + 504 p. Chicago, University Press, 1926.

ISIS

Reviewed by ROBERT W. ROGERS, *American Historical Review*, 32, 835-36, 1927.

4. — GREECE.

Calhoun, George Miller. The growth of criminal law in ancient Greece. Berkeley, Cal., University of California Press, 1927. ISIS

Diès, Auguste. Le problème de l'un et du multiple avant PLATON. *Rev. d'hist. de la philos.* 1, 5-22, 1927. ISIS

Evans, George W. The Greek idea of proportion. *The American Mathematical Monthly*, 34, 354-57, 1927. ISIS

Heiberg, J. L. Mathematici Graeci minores. (*Det Kgl. Danske Videnskabsnernes Selskab. Historiskfilologiske Meddelelser*. XIII, 3). 107 p. København, ANDR. FRED. HOST & Son, 1927. ISIS

Contains the following texts: 1. DIDYMOS of ALEXANDRIA (first half of first century B. C.). Measurement of timber; 2. DIOPHANES. Measurements of circles, polygons, spheres, cylinders. If d is the diameter, the circumference measures $d(3 + 1/7)$ and the surface of the circle $d^2 \cdot 11/14$; etc. (these two items fill more than half of the book; the Greek text is accompanied by a German translation; the following items are not translated); 3. Scholies to 2; 4. New scholies to EUCLID's Data; 5. ANTHEMOS (first half of sixth century) and the Fragmentum bobiense; 6. Liber de ponderibus (in Latin). No glossary. A mathematical discussion of these texts is very desirable. G. S.

Heichelheim, F. Zum Weiterleben der griechischen Zahlenbuchstaben. *Zeits. d. Deut. morgenl. Ges.*, n. F., vol. 6, 78-81, 1927. ISIS

The author refers to HALLO's paper in vol. 5 of the above journal (see *Isis*, 9, 549), in which it is shown that the Greek use of letters as figures was taken up in various modes by other peoples, — Copts and Aethiopians, who took over the system mechanically, Jews and Syrians, who retained the original order but introduced small changes by the intercalation and elimination of individual letters, and Armenians, who retained only the principle, greatly altering the series by the introduction of numerous new signs. HALLO explained the notable differences in the reception of the Greek letter-numbers by the facts of national psychology. The present author would rather attribute the differences to the intensity of the Graeco-Roman civilization, — Egypt

having received a particularly strong impress of Hellenism, Armenia a relatively weak one. J. S.

Kaerst, Julius. Geschichte des Hellenismus. Bd. II Das Wesen des Hellenismus. 2. Aufl. XII + 409 p. Leipzig, TEUBNER, 1926. ISIS

Reviewed by JOSEPH VOGT in *Deutsche Literaturzeitung*, 1269-1272, 1927

Knorringa, H. Emporos; data on trade and trader in Greek literature, from HOMER to ARISTOTLE. 144 p. Amsterdam, H. J. PARIS, 1926. ISIS

Reviewed by VICTOR EHRENBERG in *Deutsche Literaturzeitung*, 1308-11, 1927.

Lacaze, André. Les théories musicales des philosophes grecs. *Rev. d'hist. de la philosophie*, I, 152-167, 1927. ISIS

Après avoir élevé une protestation contre le fait que les historiens se sont trop peu intéressés jusqu'ici à l'esthétique musicale propre aux penseurs grecs, l'auteur rappelle ce qu'il faut entendre sous le nom de caractère modal d'une mélodie, et en quoi la gamme des grecs était une « gamme descendante ».

L. G.

Liddell, Henry George and Scott, Robert. A Greek-English lexicon. A new edition, revised and augmented throughout by HENRY STUART JONES, with the assistance of RODERICK MCKENZIE, and with the co-operation of many scholars. Part 3 : *διάλειμμα — ἐξευτελιστής*. p. 401-592, 2 p. addenda et corrigenda. New York, Oxford University Press, American Branch, 1927. (\$3.50). ISIS

When the first part of the dictionary appeared in 1925, we devoted a long review to his great undertaking (*Isis*, 8, 200-02). It is pleasant to notice that the publication continues regularly, and considering its size, remarkably fast. The first three parts cover 592 large pages in small type, and carry us almost to the end of the letter ϵ ; that is, almost a third of the whole work is already available. G. S.

Loria, Gino. Nota sopra un' antica soluzione del problema di Delo. *Il Bollettino di Matematica*, Sezione Storica-bibliografica, p. I-II, 1927. ISIS

Magnien, Victor. Les facultés de l'âme d'après PLATON, HIPPOCRATE et HOMÈRE. *L'acropole*, I, 300-314, 1926. ISIS

Il y a « identité foncière entre les idées d'HOMÈRE, les idées d'HIPPOCRATE et les idées de PLATON sur les facultés de l'âme, leur nature et leurs fonctions. » L. G.

Mayser, Edwin. Grammatik der griechischen Papyri aus der Ptolemäerzeit. Mit Einschluss der gleichzeitigen Ostraka und der in Ägypten verfassten Inschriften. Bd. II : Satzlehre. Analyt. Teil. Erste Hälfte. XX + 390 p. Leipzig, TEUBNER, 1926. ISIS

Reviewed by ¹W. SCHUBART, *Deutsche Literaturzeitung*, 1558-60, 1927.

Myres, John Linton. The political ideas of the Greeks, with special reference to early notions about law, authority, and natural order in relation to human ordinance. 436 p. New York, Abingdon Press, 1927. ISIS

Ramsay, Sir Walter Marlow. Asianic elements in Greek civilization. (Gifford Lectures, Edinburgh, 1915-16). London, MURRAY, 1927. ISIS

Sigerist, Henry E. Antike Heilkunde (*Tusculum Schriften*, 7, 48 p. München, HEIMERAN, 1927. ISIS

„ In den folgenden Zeilen soll nicht so sehr die Entwicklung der griechischen Medizin geschildert werden, als vielmehr ihr Wesen und ihre Leistung. Die Geschichte der griechischen Medizin umfasst etwa ein Jahrtausend. In dieser langen Entwicklungszeit haben sich die Anschauungen vielfach gewandelt. Der Wissensstoff hat sich von Jahrhundert zu Jahrhundert gewaltig gemehrt. Aber der griechische Arzt, der mit tastenden Versuchen am Anfang der Entwicklung steht und der Arzt, der mit ungeheurem Wissen beladen, die Entwicklung beschliesst, sie unterscheiden sich in ihrem ärztlichen Denken und Handeln nur wenig voneinander. „

Sudhoff, Karl. Kos und Knidos. Erschautes, Erforschtes und Durchdachtes aus der südöstlichen Aegaeis mit 5 Karten und 40 Abbildungen. 116 S. (*Münchner Beiträge*, Heft 4-5). München, Münchner Drucke, 1927. ISIS

5. — ROME.

Chapot, Victor. Le monde romain. (*L'Évolution de l'humanité*, dirigée par HENRI BERR). xv + 503 p. Paris, Renaissance du Livre, 1927. ISIS

Reviewed by R. V. D. MAGOFFIN, *American Historical Review*, 33, 97-98, 1927.

Homo, Léon. Les institutions politiques romaines, de la cité à l'état. (*L'Évolution de l'humanité*, dirigée par HENRI BERR). xvi + 471 p. Paris, Renaissance du Livre, 1927. ISIS

Reviewed by DONALD MCFAYDEN, *American Historical Review*, 33, 98-101, 1927.

Jullian, Camille. Histoire de la Gaule. Tome VIII. Les empereurs de Trèves. II. — La terre et les hommes, Paris, HACHETTE, 1926 ISIS

Volume I appeared in 1908.

Louis, Paul. Ancient Rome at work, an economic¹ history of Rome from the origins to the empire. Translated by E. B. F. WAREING. (*The History of Civilization Series*). xiv + 347 p., 4 plates, maps. London, KEGAN PAUL, 1927. ISIS

Mattingly, Harold. A guide to the exhibition of Roman coins in the British Museum. 81 + 7 p., 8 pl. London, British Museum, 1927. ISIS

II. MIDDLE AGES.

6. — MIDDLE AGES (*generalities*).

Ciasca, Raffaele. L'arte dei medici e speciali nella storia e nel commercio fiorentino dal secolo XII al XV. (*Biblioteca Storica Toscana* a cura della R. Deput. Toscana di Storia Patria, IV) VI + 811 p. Firenze, LEO OLSCHKI, 1927. ISIS

Clark, Maude Violet. The medieval city state : an essay on tyranny and federation in the later Middle Ages. VIII + 220 p. London, METHUEN, 1926. ISIS

Reviewed by EUGENE H. BYRNE, *American Historical Review*, 33, 101-103, 1927.

Crumpt, Charles George and Jacob, E. F. (editors). The legacy of the Middle Ages. XII + 549 p., 42 pl. Oxford, Clarendon Press, 1926. ISIS

Reviewed by L. J. PAETOW, *Speculum*, 2, 225-227, 1927.

Dempf, Alois. Die Hauptform mittelalterlicher Weltanschauung. Eine geisteswissenschaftliche Studie über die Summa. 179 p. München. OLDENBOURG, 1925. ISIS

Reviewed by E. SEEBERG, *Deutsche Literaturzeitung*, 1841-46, 1927.

Dempf, Alois. Das Unendliche in der mittelalterlichen Metaphysik und in der Kantischen Dialektik. (*Veröff. d. kath. Inst. für Philosophie*, Band 2, Heft 1). VIII + 91 p. Münster i. W., ASCHENDORFF, 1926. ISIS

Ehrismann, Gustav. Geschichte der deutschen Literatur bis zum Ausgange des Mittelalters. Bd. II. Teil I : Die mittelhochdeutsche Literatur. 1 : Frühmittelhochdeutsche Zeit. 2 : Hälfte 1, Blütezeit. (*Handb. d. dtsh. Unterr. an höh. Schul.* begründ. von A. MATTHIAS, Bd. VI, T. II). XVIII + 358 p.; XVII + 350 p. München, C. H. BECK, 1922; 1927. ISIS

Reviewed by S. SINGER in *Deutsche Literaturzeitung*, 1262-66, 1927.

Ellis, T. P. Welsh tribal law and custom in the Middle Ages. Two volumes. XIV + 456; VI + 460 p., maps. Oxford, Clarendon Press, 1926. ISIS

Reviewed by F. N. ROBINSON, *American Historical Review*, 33, 104-107, 1927.

Gougaud, (Dom) Louis. Devotional and ascetic practices in the Middle Ages. English edition prepared by G. C. BATEMAN. XIII + 238 p. London, BURNS, OATES, 1927. ISIS

Original French edition, Paris, 1926.

Home, Gordon (Cochrane), and Foord, Edward. Mediaeval London. 382 p., illustrated. London, BENN, 1927. ISIS

Huelsen, Christian. Le chiese di Roma nel Medio Evo : Cataloghi ed appunti. 10 + 640 p., 2 plans. Florence, OLSCHKI, 1927. ISIS

Mackenzie, William Mackay. The mediaeval castle in Scotland. (The Rhind Lectures in archaeology, 1925-26). XII + 249 p. London, METHUEN, 1927. ISIS

Molsdorf, Wilhelm. Christliche Symbolik der mittelalterlichen Kunst. 2. erw. Aufl. XV + 294 p., 11 plates. Leipzig, K. W. HIERSEMANN, 1926. ISIS

First published under different title in 1920. Reviewed by HERMANN WOLFGANG BEYER in *Deutsche Literaturzeitung*, 993-995, 1927.

Pirenne, Henri. Les villes du Moyen Age : essai d'histoire économique et sociale. 206 p. Bruxelles, LAMERTIN, 1927. ISIS

Original text of the Princeton lectures published in English by the Princeton University Press, 1925.

Sternberg, Maximilian. Die Bedeutung der scholastischen Philosophie für das heutige medizinische Denken; eine historische und methodologische Studie. (*Abhandlungen zur theoretischen Biologie*, hrsg. von J. SCHAXEL, 24) 22 S. Berlin, BORNTÄGER, 1926. ISIS

Thorndike, Lynn. Alfodhol and almadel : hitherto unnoted mediaeval books of magic in Florentine manuscripts. *Speculum*, 2, 326-331, 1927. ISIS

Waddell, Helen. The wandering scholars. XXVIII + 292 p. Boston, HOUGHTON MIFFLIN, 1927. ISIS

Reviewed by CHARLES H. HASKINS, *American Historical Review*, 33, 175-6, 1927.

Wells, John Edwin. Third supplement to a manual of the writings in Middle English, 1050-1400. Additions and modifications to June 1926. pp. 1161-1247. New Haven, Yale University Press, 1927. ISIS

7. — BYZANTIUM.

Ebersolt, Jean. La miniature byzantine. XIII + 110 p., 72 pl., 140 miniatures. Paris, VAN OEST., 1926. ISIS

III. ORIENTAL SCIENCE AND CIVILIZATION.

8. — ASIA (*generalities*).

Western Asia.

Wensinck, A. J. Tree and bird as cosmological symbols in Western Asia. With a register comprising also « The navel of the earth » and « The ocean ». 56 p., illustrated. Verhandelingen der Koninklijke Akademie van Wetenschappen. Afdeling Letterkunde. Deel 22, 1, 1921. ISIS

Central Asia.

Amitin-Shapori, Z. L. The popular medicine of the native (« Bokharean ») Jews in Turkestan. *Bulletin de l'Université de l'Asie Centrale* (Tashkent), 1-17, 1926. ISIS
In Russian with English summary.

Boyer, A. M.; Rapson, E. J.; Senart, E. Kharoṣṭhī inscriptions discovered by Sir AUREL STEIN in Chinese Turkestan. Part II : Text of inscriptions discovered at the Niya, Endere, and Lou-lan sites, 1906-7. Transcribed and edited. 119 p., 6 pl. Oxford, Clarendon, Press, 1927. ISIS

David-Neel, Alexandria. My journey to Lhasa; the personal story of the only white woman who succeeded in entering the forbidden city. Illustrated with many photographs taken by the author. XVIII + 310 p., plates, portraits. New York and London, HARPER, 1927. ISIS

Lüders, Heinrich. Medizinische Sanskrittexte aus Turkistan. (Festschrift für RICHARD VON GARBE). 15 p. Erlangen, PALM & ENKE, 1927. ISIS

Eastern Asia.

(Including works relative to the whole of Buddhist Asia, or to India, Central and Eastern Asia combined).

Coomaraswamy, Ananda Kentish. History of Indian and Indonesian art. 295 p., 400 illustrations on 128 plates. New York, E. WEYHE, 1927. ISIS

Schröder, E. E. W. Gs. A Phœnician alphabet on Sumatra. *Journ. Amer. Or. Soc.*, 47, 25-35, 1927. ISIS

The alphabets used in India are recognized as having sprouted from branches of the Phœnician; and it has been supposed that the alphabets of the Indian Archipelago have in turn been derived from India. There are several indigenous alphabets in Sumatra, the present paper being more particularly concerned with Batak, and the author appears to argue that the transference from Phœnician sources was not through India, but was more direct, though later modifications are due to Indian influence. Comparisons show that the Batak alphabet represents in its forms a transition stage between Phœnician and Aramaean, and that the period of its transference was between the beginning and end of the 7th century B. C. The geographical limits of the Phœnician alphabet are thus to be extended to the Indian Archipelago. J. S.

9. — INDIA

Ayyangar, M. S. Ramaswami, and Rao, B. Seshagiri. Studies in south Indian Jainism. 2 parts. Madras, HOE & Co., 1922. ISIS

Ayyar, R. S. Vaidyanatha. Manu's land and trade laws. Their Sumerian origin and evolution up to the beginning of the Christian era. With a foreword by Diwan Bahadur Sir T. VIJAYARAGHAVACHARYA, 164 p. Madras, HIGGINBOTHAM, 1927. ISIS

Chatterji, Suniti Kumar. The origin and development of the Bengali language. With a foreword by Sir GEORGE ABRAHAM GRIERSON. 2 parts. Part 1: Introduction, phonology, xci + 648 p. Part 2: Morphology, Bengali index, p. 649 — 1179. Calcutta, University Press, 1926. ISIS

Datta, Bibhutibhusan. On Mûla, the Hindu term for « root ». *American Mathematical Monthly*, 34, 420-23, 1927. ISIS

Dey, Nundolal. Geographical dictionary of ancient and mediaeval India. *India Antiquary*, 55, Suppl. p. 215-262, 1926. ISIS

The completion of the work; see *Isis*, 8, 590.

J. S.

Dutt, Binode Behari. Town planning in ancient India. 355 p., plans. Calcutta, THACKER, SPINK, 1925. ISIS

Edgerton, Franklin. The Bhagavad Gita or Song of the blessed one. India's favourite Bible. 111 + 106 p. Chicago, Open Court, 1925. ISIS

Reviewed by JARL CHARPENTIER, *Journal of the Royal Asiatic Society*, 802-03, 1925.

Havell, E. B. Indian architecture. Its psychology, structure, and history from the first Muhammadan invasion to the present day. Second edition, with many illustrations. London, MURRAY, 1927. ISIS

Hillebrandt, A. Die Anschauung über das Alter des R̥gveda. *Zeits. d. Deut. morgenl. Ges.*, 6, 46-77, 1927. ISIS

The author comes to the conclusion that the period 1000-1200 B. C. represents approximately the date of the Brāhmaṇa literature, anterior to which the R̥gveda is to be placed. But the actual date of the latter work, especially that of its beginning, is at present indeterminable, though it is not necessary to assume so remote a point as 1800 B. C. There appears to be no prospect of a solution of the problem, unless cuneiform inscriptions or excavations bring help. J. S.

Macdonell, A. A. India's past; a survey of her literatures, religions, languages and antiquities. 306 p., 35 illustrations, 4 maps. Oxford, Clarendon Press, 1927. ISIS

Mehta, Nānālāl Chamanlāl. Studies in Indian painting; a survey of some new material, ranging from the commencement of the VIII century to circa 1870 A. D. XI + 129 p., plates. Bombay, TARAPOREVALA, 1926. ISIS

Radhakrishnan, Sarvepalli. Indian philosophy. vol. 2. (*Library of Philosophy*). 797 p. London, ALLEN and UNWIN, 1927. ISIS

Rele, Vasant G. The mysterious Kundalini ('The physical basis of the « Kundali (Hatha) Yoga » according to our present knowledge of Western anatomy and physiology). With a foreword by Sir JOHN WOODROFFE (ARTHUR AVALON). 112 p., 4 plates. Bombay, TARAPOREVALA, 1927. (Rs. 3/8). ISIS

This book is in the first place an account and an attempted explanation of the modification at will of certain physiological processes by a Yogi (religious devotee) of Bombay. The phenomena include stoppage of the radial and temporal pulse, and a short (six seconds) stoppage, or rather, as shown by cardiographic tracings, reduced amplitude, of the heart beats. The author, an Indian medical man, scarcely shows himself sufficiently critical in his

description of the phenomena; the explanation which he suggests is a conscious control of the sympathetic nervous system, acquired through the exercises — maintenance of certain postures, practice of regulation of the respiration — that go to the making of a Yogi.

For the historian of science the important part of the book is that in which the author describes these exercises in detail, according to the Tantric manuals, and attempts an interpretation in the language of Western science of the anatomical terms used in the Sanskrit texts. Thus, for example, he identifies for us the several nerves "without the knowledge of which the process and technique of prāṇāyāma (the fourth of the eight stages in the training of the Yogi) is not possible". The six chakras of the texts are supposed to be the sympathetic plexuses; and Kundalini, through which the stimulation of the chakras always takes place, is identified with the right vagus nerve. Other pseudo-anatomical and physiological terms also are explained in modern language. Several of the postures assumed during the physical exercises of the Yogi under training are illustrated by photographs.

It is impossible for a non-Sanskritist to judge how far the interpretations are likely to be correct; but the book will probably be found suggestive by future students and historians of ancient Indian anatomical and physiological science.

J. STEPHENSON.

Shcherbatskii, Fedor Ippolitovich. La théorie de la connaissance et la logique chez les bouddhistes tardifs. Traduits par Madame I. MANZIARLY et PAUL MASSON-OURSSEL. (*Annales du Musée Guimet, Bibliothèque d'Études*, t. 36) XI + 253 p. Paris, 1926. ISIS

Singh, Puran. The book of the ten masters. London, SELWYN and BLOUNT, 1927. ISIS

A history of the Sikh religion.

Strauss, O. Altindische Spekulationen über die Sprache und ihre Probleme. *Zeits. d. Deut. morgenl. Ges.*, n. F., vol. 6, 99-151, 1927. ISIS

A discussion of the ancient Indian speculations on the subject of speech, with an indication of their importance for wider problems of philosophy. J. S.

10. — CHINA.

Chang¹ Hung²-Chao¹ (390, 5269, 476). Shih^{2*} ya³ (9964, 12807). (*Lapidarium sinicum*). A study of the rocks, minerals, fossils and metals as known in Chinese literature. *Memoirs of the geological survey of China*, Series B, number 2, May, 1921. Peking, the Geological Survey of China, Ministry of Agriculture and Commerce. 2 + 4 + 8 + 348 + 2 + IX p., 11 pl. ISIS

Elaborate review by P. DEMIÉVILLE, *Bull. de l'École fr. d'Extrême-Orient*, 24, 276-301, 1924.

Handel-Mazzetti, Heinrich. Naturbilder aus Südwest-China: Er-

lebnisse und Eindrücke eines österreichischen Forschers während des Weltkrieges. XIV+380 p., 77 pl. Wien, Oesterreichischer Bundesverlag für Unterricht, Wissenschaft und Kunst, 1927. ISIS

Reviewed by A. HENRY in *Nature*, 119, 667-668, 1927.

Schmitt, Erich. Die Grundlagen der chinesischen Ehe. 223 p. Leipzig, BROCKHAUS, 1927. ISIS

11. — JAPAN.

Ireland, Alleyne. The new Korea. XII + 354 p., map. New York, DUTTON, 1926. ISIS

Katô, Genchi. A study of Shintô, the religion of the Japanese nation. x + 256 p., plates. Tokyo, Zaidan-Hôjin-Meiji-Seitoku-Kinen-Gakkai (Meiji Japan Society), 1926. ISIS

Murdoch, James. A history of Japan. Volume III. The Tokugawa epoch, 1652-1868. Revised and edited by JOSEPH H. LONGFORD, XVIII + 823 p. New York, GREENBERG, 1926. ISIS

Reviewed by K. ASAKAWA, *American Historical Review*, 33, 139-140, 1927.

12. — ISRAEL.

(Abot). The tractate « Fathers » from the Mishna, commonly called « Sayings of the Fathers » (Pirke Aboth). Edited with introduction, translation, and commentary by R. TRAVERS HERFORD. VII + 176 p. New York, Jewish Institute of Religion Press, 1925. ISIS

Reviewed by M. GUTTMANN in *Deutsche Literaturzeitung*, 793-795, 1927.

Abrahams, Israel. Hebrew ethical wills, selected and edited. 2 vols. (Schiff library of Jewish classics) 374 p. Philadelphia, Jewish Publication Society of America, 1926. ISIS

Hebrew text and English translation on opposite pages.

Benzinger, I. Hebräische Archäologie. (*Angelos-Lehrbücher*, Bd. 1) Dritte, neu bearbeitete Auflage. 431 Abb. im Text. Leipzig, EDUARD PFEIFFER, 1927. ISIS

Blunt, Alfred Walter Frank. Israel in world history. 127 p. Oxford, University Press, 1927. ISIS

Ehrentreu, Ernst. Untersuchungen über die Massora, ihre geschichtliche Entwicklung und ihren Geist. (*Beiträge zur semit. Phil. und*

Linguistik, hrsg. von G. BERSTRÄSSER, H. 6.) VII + 161 p. Hannover, HEINZ LAFAIRE, 1925. ISIS

Reviewed by LUDWIG BLAU, *Deutsche Literaturzeitung*, 1889-92, 1927.

Gandz, Solomon. The astrolabe in Jewish literature. *Hebrew Union College Annual*, 4, 469-486, Cincinnati, 1927. ISIS

Writings on the astrolabe are not as numerous in Hebrew as in Arabic. The following are dealt with: a treatise by IBN EZRA; JACOB BEN MACHIR's translation of a treatise by IBN AL-ŠAFFĀR (first half of eleventh century, see *Introduction I*, 716); an anonymous treatise. The author adds lists of sources in which the Hebrew transcription of the word astrolabe occurs, of other forms of this word and of other Hebrew and Arabic names. Following chapters deal with the astrolabe in Biblical exegesis and in Talmud and Halakhah. The last chapter contains the Hebrew terminology relative to various parts of the instrument. This will be very useful. G. S.

Henriques, Rose L. Mediaeval Hebrew minstrelsy: songs for the Bride Queen's Feast. Sixteen zemirot arranged according to the traditional harmonies. Illustrated by BEATRICE HIRSCHFELD, and translated into English to fit the Hebrew tunes by HERBERT LOEWE. With a foreword by the (very Rev.) Dr. J. H. HERTZ. 134 p. London, J. CLARKE, 1926. ISIS

Jirku, Anton. Das Alte Testament im Rahmen der altorientalischen Kulturen. (Wissenschaft und Bildung, 219). 103 S. Leipzig, QUELLE & MEYER, 1926. ISIS

Reviewed by JULIUS LEWY, *Deutsche Literaturzeitung*, 1593-98, 1927.

Lowe, James H. Lehem lefi hat-taf; Tutorial preparation for Mishnah and Gemara, or 'Talmud without a master. 66 p. London, Hebrew Compendium Publishing Co., 1926. ISIS

Spivak, C. D. Longevity according to Hebrew lore and tradition. *Medical Life*, 34, 191-197, 1927. ISIS

14. — ISLAM.

Asin et Palacios, Michaël. Logia et agrapha domini JESU apud musulmicos scriptores, asceticos praesertim, usitata collegit, vertit, notis instruxit. (*Patrologia Orientalis*, tome XIII, fasc. 3 et 4) 198 p. Paris, 1916-26. ISIS

This very rich collection, splendidly edited, is derived from a large number of Arabic works, excluding the Qur'ān which has already been sufficiently analyzed from this special point of view. Don MIGUEL has read many Arabic theological works for his own studies and taken notes for this special purpose, but he has not tried to examine them exhaustively, except one, which is

indeed the most important, AL-GHAZZĀLĪ's *Iḥyā' 'ulūm al-dīn*. A few volumes have been examined for him by RIBERA, ALARCÓN and MASSIGNON, but the main bulk of this staggering work has been done by Don MIGUEL himself. Each relevant text is quoted in Arabic and in Latin translation. There are very good indices. The first part of this work has been reviewed in many periodicals, and various criticisms have been answered by the author in the *Revue Biblique*: In opus cui titulus « Logia et agrapha Domini JESU apud moslemicos scriptores, asceticos praesertim, usitata » animadversiones (reprint, 5 p., January 1927). G. S.

Castagné, Joseph. Le Congrès de turkologie de Bakou en mars 1926. *Revue du Monde Musulman*, 63, 15-126, 1927. ISIS

The Congress held at Baku was the first congress of Turkish studies. Some interesting discussions took place, e.g. on the Turkish dialects and the adoption of the Latin (instead of Arabic) alphabet to write them. Various newspapers and magazines have already adopted the Latin script, with a few additional letters. The next congress will meet at Samarkand. There are about 25 million Turks, of which less than one third are in Anatolia. G. S.

Devonshire, Henriette C. (Mme. R. L.) L'Égypte musulmane et les fondateurs de ses monuments. Paris, MAISONNEUVE Frères, 1926. ISIS

Fulton, Alexander S. and Ellis, A. G. Supplementary catalogue of Arabic printed books in the British Museum. 594 p. London, QUARITCH 1926. ISIS

Gandz, Solomon. Did the Arabs know the abacus? (Yes). *American Mathematical Monthly*, 34, 308-316, 1927. ISIS

Heller, Bernard. Bibliographie des Œuvres de IGNACE GOLDZIEHER. XVIII + 101 p. Paris, PAUL GEUTHNER, 1927. ISIS

This bibliography is one of the publications of the Ecole Nationale des Langues Orientales Vivantes. It is admirable drawn up and printed and it will be indispensable for every student of Islam. A good portrait is prefixed, with a biographical introduction by LOUIS MASSIGNON. The bibliography contains lists of the periodicals, collections and encyclopedias to which GOLDZIEHER contributed: a list of his books and articles, dated year by year from 1862 to 1925 and containing 380 numbers; a list of reviews dated from 1873 to 1921 and numbered 381 to 590; titles of two maps which he drew up. Analyses in French are given of the principal books and articles written in Hungarian. It is fervently to be hoped that the project of republishing the more important of GOLDZIEHER's fugitive articles will be carried out. Muslim studies cannot afford to lose any of his work. D. B. M.

Holmyard, E. J. Chemistry in Islam. *Scientia*, 40, 289-296, 1926; trad. franç., *id.*, suppl., 102-110. ISIS

Indications d'un caractère très général sur l'œuvre de JĀBĪR, de AL-RĀZĪ.

AL-'IRĀQf, AL-JILDĀKf et sur la Rutbatu'l-hakīm, ainsi que sur les lacunes de notre connaissance de la chimie dans l'Islam. L. G.

Horten, Max. Die Philosophie des Islam in ihren Beziehungen zu den philosophischen Weltanschauungen des westlichen Orients. (*Gesch. d. Philos. in Einzeldarst.* Abt. I, Bd. 4.) 385 p. München, E. REINHARDT, 1924. ISIS

Reviewed by JOSEPH SCHACHT in *Deutsche Literaturzeitung*, 795-799, 1927.

Maack, Ferdinand. Talisman 'Turc; ein Beitrag zur magisch-quadratischen Dechifferierung von Liebes- und Krankheits-Amuletten, zum Ursprung und Wesen magischer Quadrate sowie zur wissenschaftlichen Periodologie. 180 p., 208 fig. Radeburg bez. Dresden, Dr. MADAUS & Co., 1926. ISIS

Macdonald, Duncan B. Articles sihr and simiyâ'. *Encyclopaedia of Islam*, vol. 4, 409-417, 425-26, Leyden, BRILL, 1927. ISIS

Very elaborate study completed by an abundant select bibliography (on p. 416). G. S.

Nielsen, Ditlef (editor). Handbuch der altarabischen Altertumskunde. Herausgegeben in Verbindung mit FR. HOMMEL und N. RHODOKANAKIS, mit Beiträgen von ADOLF GROHMANN und ENNO LITTMANN. Band I., Die altarabische Kultur. VIII + 272 p. Copenhagen, ARNOLD BUSCK, 1927. ISIS

Reviewed by D. B. MACDONALD, *American Historical Review*, 33, 91-92, 1927.

O'Leary, De Lacy. Arabia before MUHAMMAD. (*Trubner's Oriental Series*). IX + 234 p., maps. London, KEGAN PAUL, 1927. ISIS

Revue du Monde Musulman. Index général des années 1906-1926 (vol. 1 à 66) rédigé par ANDRÉ FEVRET, ANDRÉ MARTIN, J. ROMAN D'AMAT. VI + 331 p. Paris, ERNEST LEROUX, 1927. ISIS

Cet ouvrage contient en réalité sept index : auteurs, noms de personnes, noms géographiques, ouvrages cités, périodiques cités, mots typiques, planches et cartes. Il est regrettable que ces index n'aient pas été mieux faits, du point de vue de l'arabisant ; ils rendront cependant de grands services.

G. S.

Rodd, Francis (James) Rennell. People of the veil; being an account of the habits, organisation and history of the wandering Tuareg tribes which inhabit the mountains of Air or Asben in the Central Sahara. XVI + 504 p. illus., London, MACMILLAN, 1926. ISIS

Ruska, Julius. Über das Fortleben der antiken Wissenschaft im Orient.

Vortrag in der Berliner Gesellschaft für Geschichte der Naturwissenschaft, Medizin und Technik am 17. Juni 1927. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 112-135, 1927. ISIS

« Es ist die Welt des Faust, die uns der Orient geschenkt hat, eine Welt, die auch auf uns noch immer ihren Zauber ausübt. Aber es ist nicht nur diese Welt. Der alte Orient hat sich mit der griechischen Wissenschaft vermählt. Der neu zur Herrschaft gelangende Stern Glaube verleiht der astronomischen und mathematischen Forschung wieder Flügel. Der Glaube an die Alchemie erzeugt die experimentelle Chemie. Die Hoffnung, eine Universalmedizin zu finden, die alle Krankheiten heilt, führt zur Reform der Arzneikunde. Wenn Sie an diese geschichtlichen Zusammenhänge denken, so werden Sie auch, das darf ich wohl hoffen, die Beschäftigung mit « arabischer » Wissenschaft nicht als zwecklose oder unzeitgemässe Bemühung betrachten, sondern als eine der dringendsten Aufgaben einer Geschichte der Naturwissenschaften anerkennen. »

Sékaly, Achille. L'Université d'el-Azhar et ses transformations. *Revue des études islamiques*, 1, 95-116, 1927. ISIS

« La grande Université musulmane de la Mosquée d'El-Azhar traverse depuis quelques années un malaise profond. Ce malaise se révèle périodiquement par des manifestations plus ou moins graves, quelquefois même par des troubles, que des réformes hâtives et des concessions plus ou moins opportunes viennent calmer momentanément et qui réapparaissent à la première occasion. D'où vient ce malaise, quelles en sont les causes, quelle est la portée exacte des réformes préconisées et réalisées au cours du dernier quart de siècle, quel serait le vrai remède pour faire disparaître ce malaise et redonner à ce célèbre établissement d'enseignement islamique son lustre et son importance de jadis ? »

Sharaf, Mohammad. An English-Arabic dictionary of medicine, biology and allied sciences. XXI + 971 p. Kairo, 1926. ISIS

Reviewed by MAX MEYERHOF, *Mitt. zur Geschichte der Medizin*, 26, 206-07 1927. To the previous works of the same kind mentioned by MEYERHOF, might be added the Latin-Arabic and Latin-Turkish anatomical glossary reviewed in *Isis*, 7, 272. RUSKA's remarks might be applied to the present work. G.S.

Sheringham, Arthur Thomas. Modern Arabic sentences on practical subjects; being selections from the newspapers of Iraq, Palestine, and Egypt. XI + 240 p. London, KEGAN PAUL, 1927. ISIS

Smith, David Eugene, and Mourad, Salih. The dust numerals among the ancient Arabs. *American Mathematical Monthly*, 34, 258-260, 1927. ISIS

Spies, O. CARL SCHÖY und seine Schriften. *Zeits. d. Deut. Morgenl. Ges.*, n. F., vol. 5, 319-327, 1926. ISIS

A biographical notice of CARL SCHÖY, b. 1877, d. 1925. A mathematician

and astronomer, he became attracted by the historical side of these subjects, learnt Arabic, and became the author of a lengthy list of papers dealing with the history of oriental astronomy and geography. J. S.

Wensinck, A. J. A handbook of early Muhammadan tradition, alphabetically arranged. XVIII + 469 p. Leiden, BRILL, 1927. ISIS

Reviewed by H. LAMMENS, *Revue des études islamiques*, I, 30-31, 1927.

Wieleitner, Heinrich. KARL SCHOY. *Jahresbericht der Deutschen Mathematiker-Vereinigung*, 36, 163-167, 1927. ISIS

With a portrait different from the one published in *Isis*, but probably made at the same time. G. S.

PART III.

SYSTEMATIC CLASSIFICATION.

Including only the material which could not be included in Parts I and II. Hence studies on Japanese astronomy or on XIIIth century astronomy are not classified below under astronomy, but above, respectively under Japan (in Part II) and XIIIth Century (in Part I).

The sections forming Part III are classified as follows:

- I. *Science in general* : 15. Bibliography; 16. History; 17. Organization; 18. Philosophy.
- II. *Formal sciences* (Knowledge of forms) : 19. Logic and Theory of Knowledge; 20. Mathematics; 21. Statistical methods.
- III. *Physical sciences* (Knowledge of inorganic nature); 22. Mechanics; 23. Astronomy; 24. Physics; 25. Chemistry (Physico-chemistry, Industrial chemistry); 26. Technology.
- IV. *Biological sciences* (Knowledge of organic nature) : 27. Biology (Generalities, « Natural history »); 28. Botany (Agronomy, Phytopathology, Palaeobotany); 29. Zoology.
- V. *Sciences of the earth* (implying knowledge of both organic and inorganic nature): 30. Geodesy; 31. Geography and Oceanography; 32. Geology, Mineralogy, Paleontology, Mining; 33. Meteorology, Climatology and Terrestrial Physics.
- VI. *Anthropological and historical sciences* (Knowledge of man, past and present): 34. Anatomy; 35. Physical anthropology (anthropometry and races of man); 36. Physiology (human and comparative); 37. Psychology (human and comparative); 38. Archaeology (generalities, methods); 39. Prehistory; 40. Ethnology (primitive and popular science); 41. Superstition and Occultism.
42. Economics (economic doctrines and history; commerce; transportation and communications); 43. Sociology, Jurisprudence and Positive Polity; 44. History of Civilization (general history, historical methods, biography and chronology); 45. History of Art (Art and science; Iconography; Arts and crafts); 46. History of Language, Writing and Literature; 47. History of Morals (Moral organization of society); 48. History of Philosophy; 49. History of Religion (Science and religion).

VII. *Medicine* : 50. History, organization and philosophy of medicine ; 51. Epidemiology, History of special diseases. Public health and Social medicine ; 52. History of hospitals and of medical teaching ; 53. Pharmacy ; Pharmacology ; Toxicology.

VIII. *Education* (The methods of accumulating, imparting and diffusing knowledge) ; 54. Education (Generalities, Methods, Colleges, Universities) ; 55. Academies, societies, congresses, National and international organization of science ; 56. Bibliography. (Methods, Libraries) ; 57. Museology (Museums and Collections).

IX. 58. *Alia* ; 59. *Errata*.

The applied sciences are not disconnected from the pure sciences, but, as far as possible, the principles and applications of science are considered in the same section. However, applications based upon the principles of many sciences are dealt with separately (ex. technology ; medicine ; education).

I. — SCIENCE IN GENERAL.

15. — BIBLIOGRAPHY of SCIENCE.

Scientific Periodicals. A world list of scientific periodicals published in the years 1900-1921. Vol. 2 : Abbreviated titles and locations of sets. XII + 344 p. London, Oxford University Press, 1927.

ISIS

16. — HISTORY of SCIENCE.

(**Binoux, Prix**). Le prix Binoux pour l'année 1926 a été attribué à M. HENRY DE VARIGNY pour son ouvrage: *La mort et la biologie*, signalé dans cette bibliographie critique (section biologie). Pour les prix des années antérieures, voir *Isis*, 8, 161-3, 725; 9, 370-2). L. G.

ISIS

Bloch, M. Kommission für Geschichte des Wissens an der Akademie der Wissenschaften d. U. S. S. R. *Mitt. zur Geschichte der Medizin und der Naturwissenschaften*, 26, 281-82, 1927.

ISIS

Dannemann, Friedrich. Das Zusammenwachsen von Naturwissenschaft und Technik zur Einheit. 5 pages. Sonderdruck aus *Technik und Kultur*, Zeitschrift des VDDI. (undated, received in 1927).

ISIS

Knickerbocker, William S. *Classics of Modern Science (COPERNICUS to PASTEUR)*. XVI + 384 pp. New York, ALFRED A. KNÖPF, 1927.

ISIS

•This anthology of modern science will make the teaching of the history of science easier, also the teaching of scientific English in technical schools. There are in all 36 texts by the following authors : F. BACON, N. COPERNICUS, J. KEPLER, G. GALILEI, W. HARVEY, R. BOYLE, C. HUYGENS, A. VON LEUWENHOECK, I. NEWTON, B. FRANKLIN, LINNAEUS, J. BLACK, J. PRIESTLEY, H.

CAVENDISH, W. HERSCHHEL, K. W. SCHEEL, A. L. LAVOISIER, A. VOLTA, P. S. LAPLACE. E. JENNER, Count RUMFORD, J. DALTON, M. F. X. BICHAT, A. AVOGADRO, H. DAVY, M. FARADAY, J. HENRY, C. LYELL, C. DARWIN, T. SCHWANN, H. VON HELMHOLTZ, L. PASTEUR, J. C. MAXWELL, A. WEISMANN, N. LOCKYER, and R. KOCH. The texts can be classified as follows : general science, 1 ; astronomy, 7 ; physiology, 1 ; physics, 9 ; biology, 3 ; botany, 1 ; chemistry, 8 ; medicine, 3 ; anatomy, 2 ; geology, 1. According to nationality : English, 16 ; German, 6 ; French, 4 ; Italian, 3 ; American, 3 ; Swedish, 2 ; Dutch, 2. Each text is preceded by a brief biography. I have read a few of them. They are very unsatisfactory, the author missing the essential points, insisting on trifles, and making erroneous or misguiding statements ; e. g., LINNÉ did not discover the sexuality of plants ; LYELL's views as quoted were only a stronger repetition of HUTTON's. G. S.

Lynch, Arthur. Science : leading and misleading. 376 p. London, JOHN MURRAY, 1927. ISIS

Reviewed in *Nature*, 120, 469-70, 1927.

Meyer, Adolf. Was heisst und zu welchem Ende studieren wir die Geschichte der Naturwissenschaften ? *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 37-53, 1927. ISIS

Ostwald, Wilhelm. Geschichtswissenschaft und Wissenschaftsgeschichte. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 1-11, 1927. ISIS

Reinke, Johannes. Geschichte und Naturwissenschaft. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 12-15, 1927. ISIS

Ritter, Eugène. Trois chapitres de l'histoire des sciences. *C. R. Acad. des sc. mor. et politiques*, oct.-déc., 346-354, 1926. ISIS

Bref aperçu sur la lutte entre l'autorité ecclésiastique et les coperniciens, entre l'autorité dogmatique représentée par la Sorbonne, et les partisans de l'évolution du globe, entre la tradition biblique et l'idée de l'évolution du genre humain. Cette communication a été suivie d'observations d'EDOUARD LEROY (pp. 354-365) qui portent l'attention sur les problèmes généraux qui se posent à la pensée religieuse et à la pensée philosophique. L. G.

Ruska, Julius. Dritter Jahresbericht des Instituts für Geschichte der Naturwissenschaften zu Heidelberg. (Heidelberger Akten der von-Portheim-Stiftung.) 16 p. Heidelberg, CARL WINTER, 1927. ISIS

This is the last report sent by the present director of the Heidelberg institute, because he has been appointed director of the new and larger institute recently established in Berlin. It contains the history of the movement which has gradually led to the creation of the new institute, quoting extensively from an address delivered by Prof. PUSCHMANN of Vienna, in Heidelberg 1889. G. S.

Sarton, George. Der Neu-Humanismus. Autorisierte Uebersetzung von CARL GRAF KLINCKOWSTROEM. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 16-36, 1927.

ISIS

Translation of The New Humanism, published in *Isis*, 6, 9-34, 1924.

Sarton, George. Introduction to the history of science. Volume I. From HOMER to OMAR KHAYYAM. (Carnegie Institution of Washington, Publication no. 376). XII + 839 p. Baltimore, WILLIAMS & WILKINS, 1927. (\$ 10.)

ISIS

The Introductory chapter and Table of Contents were also printed separately (XII + 52 p., Washington, 1927; edition of 200 copies, out of print.) This first volume was reviewed (1) by J. W. S. JOHNSON, in *Ugeskrift for Læger*, Copenhagen 1927, no. 27, p. 578; (2) by FLORIAN CAJORI, in *Science*, 66, 260-262, 1927; (3) by J. K. WRIGHT, in *Geographical Review*, New York, October 1927; (4) by H. WIELEITNER, in *Mitteilungen zur Geschichte der Medizin und der Naturwissenschaften*, 26, 234, 1927; (5) by F. M. G. DE FEYFER, in *Bijdragen tot de geschiedenis der geneeskunde*, 7, 614-15, Amsterdam, 1927; (6) by C. SINGER, in *The Times Literary Supplement*, London, Oct. 20, 1927, p. 730; (7) by ALDO MIELI, in *Archivio di storia della scienza*, 8, 241-4, 1927; (8) by EDMUND O. VON LIPP MANN, in *Chemiker-Zeitung*, Nr. 66, p. 641, 1927; (9) by L. MASSIGNON, in *Revue des études islamiques*, 1927, 10; (10) by E. J. HOLMYARD, in *Nature*, vol. 120, 648-49, 1927.

Schuster, Julius. Die Geschichte der Naturwissenschaften und wir. Dem Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik zum Geleit. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, I-VI, 1927.

ISIS

Shipley, Maynard. The war on modern science: a short history of the fundamentalist attack on evolution and modernism. XIV + 415 p. New York, KNOPF, 1927.

ISIS

Timpanaro, Sebastiano. La storia della scienza. *L'arduo*, 1, 10-17, 1921.

ISIS

Vernadskii, V. I. Ideas on the present importance of the history of science. *Leningrad Akad. Sci. S. S. S. R. Trav. Commission Hist. Sci.* I. 1-17, 1927.

ISIS

17. — ORGANISATION of SCIENCE.

(Internal organization is meant, see *Isis* I, 195. For external, national or international, organization see section 55).

Washburn, Edward W. (editor). International critical tables of numerical data, physics, chemistry and technology. Prepared under

the auspices of the International Research Council and the National Academy of Sciences by the National Research Council of the United States of America. In 5 vols. Vol. 1 : xx + 415 p. New York, McGRAW-HILL Book Co., 1926.

ISIS

Elaborate review by EZER GRIFFITHS in *Nature*, 119, 735-738, 1927.

18. — PHILOSOPHY of SCIENCE.

Dingler, Hugo. Der Zusammenbruch der Wissenschaft und der Primat der Philosophie. 400 S. München, ERNST REINHARDT, 1926.

ISIS

Reviewed by DIETRICH MAHNKE, *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 216-232, 1927.

Driesch, Hans. Metaphysik der Natur. (Handbuch der Philosophie). 95 S. München, R. OLDENBOURG, 1927.

ISIS

Reviewed by E. O. VON LIPPMANN in *Chemiker-Zeitung*, 1927, Nr. 58.

Lodge, Sir Oliver. Science and human progress. (Halley Stewart Lectures, 1926). 187 p. London, ALLEN and UNWIN, 1927.

ISIS

Reviewed in *Nature*, 120, 436, 1927.

Russell, Bertrand (Arthur William). The analysis of matter. London, KEGAN PAUL, 1927.

ISIS

II. — FORMAL SCIENCES

(Knowledge of Forms).

19. — LOGIC and THEORY of KNOWLEDGE.

Enriques, Federigo. Zur Geschichte der Logik : Grundlagen und Aufbau der Wissenschaft im Urteil der mathematischen Denker. Deutsche Übersetzung von L. BIEBERBACH. (*Wissenschaft und Hypothese*, Band 26). v + 240 p. Leipzig, TEUBNER, 1927.

ISIS

Prantl, Carl von (1820-1888). Geschichte der Logik im Abendlande. Manuldruck der Orig.-Ausgabe, 1855. 4 Bände. Leipzig, GUSTAV FOCK, 1927.

ISIS

Original edition, Leipzig, 1855-1870.

• 20. — MATHEMATICS.

Becker, Oskar. Mathematische Existenz. Untersuchungen zur Logik und Ontologie mathematischer Phänomene. (Sonderdruck aus *Jahrb. Philos. u. phänomenolog. Forschung*, Bd. 8, herausgegeben von E. HUSSERL.). VIII + 369 S., Halle a. S., MAX NIEMEYER, 1927.

ISIS

Ein mit allen Mitteln der HUSSERL'schen Phänomenologie und mit ganz vorzüglichen Fach- und historischen Kenntnissen unternommener Versuch, die Frage nach dem « Seinssinn » des Mathematischen zu klären und die heute im Vordergrund stehenden Streitfragen über die Grundlagen der Mathematik historisch und kritisch zu beleuchten. Es ist kein Wunder, dass der Verfasser mit dem Streit zwischen BROUWER und HILBERT (Intuitionisten und Formalisten) beginnt, wobei er mehr den Intuitionisten zuneigt und an den letzten Arbeiten HILBERTS eingehende Kritik übt. Das Problem dieses Gegensatzes wird bis ins Altertum zurückverfolgt, wo es uns als der Widerstreit zwischen den Anhängern einer kontinuierlichen (ANAXAGORAS) und einer atomistischen (DEMOKRITOS) Weltanschauung entgegentritt. Die Theorie des Kontinuums, das Problem des Unendlichen im Allgemeinen sowohl wie in Beschränkung auf die transfiniten Zahlen, werden ebenso durch die ganze Geschichte verfolgt. Dazu tritt gegen den Schluss eine weit ausgreifende Untersuchung der Entwicklung des « Mathematisch-Formalen » mit eigenen Kapiteln über PLATON, ARISTOTELES, DESCARTES, LEIBNIZ und KANT. Ein mathematischer Anhang bezieht sich auf die neuesten Theorien. In den Fußnoten erscheint die reiche durchgearbeitete Literatur. Auch reine Historiker können viel aus dem Buch lernen. Leider fehlt ein Namenindex, der bei der Fülle des Stoffs sehr erwünscht gewesen wäre. H. W.

Behmann, H. Mathematik und Logik. (*Math.-phys. Bibl.*, 71). 59 S. Leipzig, B. G. TEUBNER, 1927. ISIS

Boutroux, Pierre. (1880-1922). Das Wissenschaftsideal der Mathematiker. (*L'Idéal scientifique des mathématiciens dans l'antiquité et dans les temps modernes*). Autorisierte deutsche Ausgabe von HILDA POLLACZEK. (*Wissenschaft und Hypothese*, Band 28). IV + 253 p. Leipzig, TEUBNER, 1927. ISIS

Original French edition Paris 1920 (*Isis*, 4, 93-96).

Carus, Edward Hegeler. Invariants as Products and a Vector Interpretation of the Symbolic Method. VIII + 44 pp. Chicago, The Open Court Publishing Co., 1927. ISIS

« The important discoveries of CLEBSCH and GORDAN in the theory of invariants were made by adopting the special method invented by ARONHOLD, called the symbolic notation. With this method of attack for the difficult problems of the theory of invariants, CLEBSCH and GORDAN proved that every invariant and covariant can be expressed as a sum of symbolic products. By developing relations between symbolic expressions CLEBSCH and GORDAN proved for the case of binary forms that all invariants and covariants of any form or set of forms can be expressed rationally in terms of a finite number; and they developed the method by which we can actually find this finite set of invariants and covariants for a given system.

« Our object is to connect the theorems of the symbolic notation with the ideas of vector analysis. The results may be of interest not only for the purpose of studying invariants but also for the further development of vector analysis. »

Coolidge, Julian Lowell. Einführung in die Wahrscheinlichkeits-

Rechnung. (*Sammlung Mathem.-physik. Lehrbücher*; Band 24.)
Deutsche Ausgabe von FRIEDRICH M. URBAN. IX + 212 p. Leipzig,
TEUBNER, 1927. ISIS

Forder, Henry George. The foundations of Euclidean geometry.
XIII + 349 p., 1 plate. Cambridge, University Press, 1927. ISIS

« In the beginning of last century, it was still possible to regard the Greek Geometry as the most rigorously logical body of doctrine ever erected, for the mathematics of that day which was of modern origin was clearly based on insecure foundations. The critical mathematicians of the last century and of this have succeeded in placing Analysis on what seems to most an unassailable basis and the results of their labours are readily accessible in a number of excellent text-books. But although the Euclidean Geometry is the oldest of the sciences and has been studied critically for over two thousand years, it seems that there is no text-book which gives a connected and rigorous account of that doctrine in the light of modern investigations; for HILBERT's *Grundlagen* is a work of research, while the books of VAHLEN, SCHUR, VEBLEN and BAKER are preoccupied with Projective Geometry. It is hoped that this book will fill that gap. »

Gibson, G. A. « Sketch of the history of mathematics in Scotland to the end of the 18th century, Part 1 ». *Proceedings of the Edinburgh Mathematical Society*, series 2, vol. 1, part 1, pp. 1-18, 1927. ISIS

Thirty-four volumes of the *Proceedings* were published in the format $5\frac{1}{2} \times 8\frac{1}{2}$ inches. This article is in the first part of the new series, which is of format $7\frac{1}{4} \times 9\frac{3}{4}$ inches. In recent years there have been several publications of interest to the student of mathematics in Scotland; GIBSON's « Some criticisms of ROBERT SIMSON by SIR T. L. HEATH », *Proc. Edinb. Math. Soc.*, 44, 39-46, 1926; GIBSON's « JAMES GREGORY's mathematical work : a study based chiefly on his letters », *idem*, 40, 2-25, 1923; TWEEDE's volume on JAMES STIRLING, 1922, and his earlier article in the *Mathematical Gazette*, 10, 119-128, 1920; TWEEDE's « Study of the life and writings of COLIN MACLAURIN », (*Mathematical Gazette*, 8, 133-151, 1915, and 9, 303-305, 1919; the volumes edited for the NAPIER tercentenary celebration by HORSBURG (1914), and KNOTT (1915); and MACKAY's « Mathematical Correspondence, ROBERT SIMSON, MATTHEW STEWART, JAMES STIRLING », *Proceedings, Edinb. Math. Soc.*, 21, 2-39, 1903.

GIBSON's history deals with the mathematics at the four Scotch Universities, which were founded before 1600 : St. Andrews (1411), Glasgow (1450), Aberdeen (1495), and Edinburgh (1582). The first outstanding mathematician was JOHN NAPIER (1550-1617) and he was followed by JAMES GREGORY (1638-1675) and DAVID GREGORY (1661-1708). It is to this point that the first part of GIBSON's Sketch carries us.

R. C. A.

Hancock, Harris. The « mystic » numeral 7. *American Mathematical Monthly*, 34, 293-296, 1927. ISIS

Journal für die reine und angewandte Mathematik (CRELLE's Journal), vol. 157, 1926-27. ISIS

This volume is a « Jubiläumsband » since the journal was founded in 1826. Among others the first volume contained four memoirs by ABEL, and five by STEINER. The jubilee volume differs from the usual volume by having fourteen pages of introductory matter and three full page supplements : a) portraits of PONCELET, MÖBIUS, STEINER, and PLÜCKER; b) SCHIELBACH, KUMMER, SCHRÖTER and HELMHOLTZ; c) GAUSS on the terrace of the Göttingen observatory. The introductory matter consisted of a sketch of the *Journal* and its editors by K. HENSEL (pp. 1-2); « AUGUST LEOPOLD CRELLE zum Gedächtnis » by W. LOREY, (pp. 3-11) and an extract of a letter from MITTAG-LEFFLER (pp. 12-14).

CRELLE's *Journal* was founded with GERGONNE's *Annales de Mathématiques Pures et Appliquées* (1810-32) as a model. Success in the undertaking was partly assured through an arrangement he made with the Kultusministerium whereby he was allowed to add to the title of the *Journal* the words to be found in every volume through 148, 1918 : « Mit tätiger Beförderung hoher Königlich Preussischer Behörden. » The « Beförderung » consisted on the one hand in issuing strong official recommendation of the *Journal* not only to universities, and institutions of a similar nature, but also, for example, to government boards and, through Prussian ambassadors, to foreign countries. On the other hand the « Beförderung » involved the purchase of a number of copies of the *Journal* which were distributed to various schools — a custom prevailing to very recent times. In this way WEIERSTRASS, for example, while a gymnasium pupil, received inspiration by discovering an uncut copy of the *Journal* « mit den schönen Abhandlungen von STEINER, von denen auch ein Primaner etwas verstehen konnte. » R. C. A.

Lietzmann, Walther. Aufbau und Grundlage der Mathematik. Ergänzungsheft 3 zum « *Math. Unterrichtswerk* ». 89 S. Leipzig, TEUBNER, 1927. ISIS

Behandelt in 4 Kapiteln die Logik in der Mathematik, die Grundlegung der Geometrie, die Grundlegung der Arithmetik und die Grundlegung der Analysis, leichtverständlich und anregend. H. W.

Lorey, Wilhelm. WILHELM AHRENS zum Gedächtnis. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 328-333, mit einem Bildnis, 1927. ISIS

WILHELM E. M. G. AHRENS (Lübz, Mecklenburg, 1872- Rostock 1927) was well known for his collections of mathematical recreations and anecdotes, the best of their kind. G. S.

Pasch, Moritz. Mathematik am Ursprung. *Gesammelte Abhandlungen über Grundfragen der Mathematik*. 4, 149 S. Leipzig, Felix Meiner, 1927. ISIS

« Der Verfasser hat sich schon seit 1882, da seine « Vorlesungen über neuere Geometrie » erschienen (2. Aufl. 1926), und seine « Einleitung in die Differential- und Integralrechnung », mit den Grundlagen der Mathematik befasst. 1909 erschien sein Werk « Grundlagen der Analysis », das dann 1914 durch « Veränderliche und Funktion » ergänzt wurde. Daneben schrieb er noch eine Reihe von Aufsätzen in die *Annalen der Philosophie und philosophischen*

Kritik, und solche, aus der neuesten Zeit stammende Aufsätze sind es, die hier abgedruckt wieder sind. Zuerst zwei in denen der Versuch, die Geometrie auf empirische Axiome zu gründen, fortgesetzt wird: « Der starre Körper in der Geometrie » und « Die Begriffswelt des Mathematikers in der Vorhalle der Geometrie », dann ein Aufsatz im Anschluss an (und zur Widerlegung von) VAHINGERS Anwendung der « Philosophie des Als Ob » auf die Mathematik: « Der Begriff des Differentials », hierauf mehrere Abhandlungen unter dem gemeinsamen Titel « Begriffsbildung und Beweis in der Mathematik », ferner in Ergänzung zu den beiden ersten Aufsätzen ein solcher über « Dimension und Raum in der Mathematik », den Schluss bildet der allgemeine Artikel « Die axiomatische Methode der neueren Mathematik ». —
H. W.

Pasch, Moritz. Vorlesungen über neuere Geometrie. Zweite Auflage mit einem Anhang: Die Grundlegung der Geometrie in historische Entwicklung, von MAX DEHN. x + 275 S., 115 Abbildungen. Berlin, SPRINGER, 1926.
ISIS

Der historisch orientierte Anhang von DEHN beginnt auf S. 185 und berücksichtigt 4 Gesichtspunkte: 1) Das Parallelenaxiom; 2) Die Grundlegung der projektiven Geometrie; 3) Die Stetigkeitsvoraussetzungen; 4) Die Axiomensysteme.
H. W.

Sanford, Vera. The history and significance of certain standard problems in algebra. viii + 102 pp. *Contributions to Education*, No. 251, Teachers College, Columbia University. New York, 1927.
ISIS

« This study discusses the role of verbal or « clothed » problems in algebra. It describes the features that tend to make a problem appear to the pupil as real and important, even though it is not practical in everyday life. It also considers the use made in times past of mathematical recreations and of questions of current business, economic, or scientific interest, all of which have direct bearing on the work of the modern school. It analyses the reasons for the retention of certain problems and for the elimination of others, and gives the history of types which have persisted because of the reality to the pupil rather than because of any direct application to human needs. » Contents: 1. Why problems are taught; 2. Efforts to make problems interesting; 3. Methods of solving problems; 4. Commercial problems; 5. Genuine problems from scientific mathematics; 6. Recreations; 7. Pseudo-real problems in present-day text books; 8. Changes in problem material; 9. The future of problems; Bibliography.

Trinks, F. Geschichtliche Daten aus der Entwicklung der Rechenmaschine von PASCAL bis zur Nova-Brunswiga. *Die Braunschweiger G-N-C-Monatschrift*, 14, 249-275, 1927.
ISIS

Wieleitner, Heinrich. Zur Frühgeschichte des Imaginären. *Jahresbericht der deutschen Mathematiker-Vereinigung*, 36, 74-88, 1927.
ISIS

Valuable clean-cut survey of work, particularly by CARDANO and BOMBELLI, with special reference to publications of E. BORTOLOTTI, 1923-25. R. C. A.

Wieleitner, Heinrich. Mathematische Quellenstudien im Unterricht. *Unterrichtsbücher für Mathematik und Naturwissenschaften*, 33. Jahrgang, 312-15, 1927. ISIS

Wieleitner, Heinrich. Mathematische Quellenstudien. *Das Weltall*, 26. Jahrgang, 186-91, 1927. ISIS

These two articles explain the necessity of referring to the old scientific sources, to go as near to these sources as possible. The argument is illustrated by means of well chosen examples. Special attention is paid to the excellent collection of source books, the *Mathematisch-naturwissenschaftlich-technische Bücherei*, published by OTTO SALLE, Berlin, and of which a few volumes are included in this bibliography (see WIELEITNER, KLIEM, WENZEL, HOPFF, FLADT). G. S.

Wieleitner, Heinrich. Rechnen und Algebra. (*Mathematische Quellenbücher*, 1.) VIII + 75 p., 5 fig. Berlin, OTTO SALLE, 1927. (Mk. 2) ISIS

The author has given us already a number of excellent books on the history of mathematics, but the present one, in spite of its small size, increases our debt to him quite considerably. It is an anthology of mathematical texts illustrating the development of arithmetic and algebra. Its high value is due to the editor's exceptional competence and to the careful selection and presentation of the items. The method is as follows: each item is reproduced as in the original or literally translated (without paying attention to diplomatic details; e.g. abbreviations are generally replaced by the full words); then this text is explained or translated into modern notation. The sources are very exactly indicated, and each item is briefly but clearly dated and otherwise located. This volume contains 23 items of which I mention at random nos. 3, 10, 15, 20: Die Summe der geometrischen Reihe; Arabische Erbteilungsaufgabe; Erstes Auftreten des Logarithmenbegriffs als einer zweiten Umkehrung des Potenzierens; Einheitliche Behandlung der verschiedenen Formen der quadratischen Gleichung. We ought to have such books in English! G. S.

Wieleitner, Heinrich. Geometrie und Trigonometrie. (*Mathematische Quellenbücher*, 2.) VIII + 68 p. 22 fig. Berlin, OTTO SALLE, 1927. (2 Mk.) ISIS

The same general remarks apply to this book as to the first of the same series: Rechnen und Algebra. The case of geometry and trigonometry is somewhat different. With regard to geometry (i.e. elementary geometry); the evolution was essentially completed in the first half of the third century B. C. Trigonometry was a child of astronomy and thus was at first spherical. Its formal elaboration was considerably delayed; and did not reach a satisfactory stage until the eighteenth century, nor was its connection with geometry generally recognized before that time. Even now trigonometry is still too often dissociated from elementary geometry. This anthology contains 21 items; I quote nos. 1, 6, 11, 16, 21: Das Mönchchen des HIPPOKRATES; Der Ptolemäische Lehrsatz; Näherungskonstruktion des regelmässigen Fünfecks; Der

sphärische Sinussatz, abgeleitet an einem rechtwinkligen Dreieck; Der Moivre'sche Lehrsatz. This volume, as also the earlier one, is followed by a small dictionary of authors and editors quoted. Very good indeed. G. S.

III. — PHYSICAL SCIENCES

(Knowledge of inorganic nature).

22. — MECHANICS.

(Including Celestial Mechanics.)

Carmichael, Robert D. (and others). A Debate on the Theory of Relativity. With an introduction by WILLIAM LOWE BRYAN. VIII + 154 pp. Chicago, Open Court Publishing Co., 1927 (\$ 2.00)

ISIS

Debate organized by the Indiana Chapter of Sigma Xi at Indiana University, on May 21 and 22, 1926. R. D. CARMICHAEL and HAROLD T. DAVIS spoke for the theory, the former dealing with the principles, the latter with the experimental verification; WILLIAM D. MACMILLAN and MASON E. HUFFORD spoke against it. G. S.

Whittaker, Edmund Taylor. The outstanding problems of relativity. From the presidential address to Section A (Mathematical and Physical Sciences) of the British Association delivered at Leeds on Sept. 5. *Nature*, 120, 368-371, 1927; also in *Science*, 66, 223-229, 1927. ISIS

23. — ASTRONOMY.

Drecker, Joseph. Die Theorie der Sonnenuhren. (*Die Geschichte der Zeitmessung und der Uhren* hrsg. von ERNST VON BASSERMANN-JORDAN, Bd. I, Lief. E) XI + 112 p., 14 pl. Berlin, WALTER DE GRUYTER, 1925.

ISIS

This is a very elaborate account of the mathematical theory of sundials. Says the author: « Dem Charakter des Gesamtwerkes: ' Die Geschichte der Zeitmessung und der Uhren ' entsprechend wurde auch in diesem Teile, der die Mathematik der Sonnenuhr enthält, die geschichtliche Folge als Einteilungsprinzip gewählt. Ausgehend von dem durch VITRUVIUS und PROLEMAEUS Überlieferten wird das Problem, die Linien der antiken Sonnenuhr zu konstruieren und zu berechnen, für alle Arten Aufnahmeflächen, die an erhaltenen Sonnenuhren vorkommen, gelöst. Die Gleichungen aller auftretenden Kurven werden abgeleitet, und die Kurven selbst durch Zeichnungen zur Anschauung gebracht. (Kapitel I-XII). Den Übergang zur modernen Sonnenuhr bildet die Sonnenuhr für italische und babylonische Stunden, die mit den antiken Stunden den beweglichen Anfang, mit den modernen die das ganze Jahr hindurch gleichbleibende Länge gemein haben. Von den modernen Sonnenuhren nehmen die tragbaren wegerl ihres grossen Formenreichtums unser besonderes Interesse in Anspruch. Ausgeschlossen

aber mussten die Sonnenuhren bleiben, die weder in theoretischer noch in praktischer Hinsicht auf eigenartiger Grundlage beruhen, wie sie namentlich bei den Schriftstellern des 17. und 18. Jahrhunderts als müßige Spielereien in unzähligen Varietäten gefunden werden. Die beiden letzten Kapitel handeln über wahre und mittlere Zeit und über den Einfluss der atmosphärischen Refraktion. » It is splendidly published; in fact, too splendidly. It does not seem fair to place such a valuable book beyond the reach of those who may need it most. Let us hope that a popular edition will be published later. The author is well known to our readers because of his translation of PROTEMY's Planisphere which appeared in *Isis*, 9, 255-78. Another part of this monumental work, SCHÖY's Gnomonik der Araber was reviewed in *Isis*, 5, 534. G. S.

Feldhaus, Franz M. Zur Geschichte der Planetarien. *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 89-91, 1927. ISIS

Lehmann-Nitsche, Robert. Das Sternbild des Bohrers. *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 92-3, 1927. ISIS

Schoch, Karl. Planeten-Tafeln für Jedermann. Zur Berechnung der geozentrischen Oerter und Helligkeiten der grossen Planeten (und des Mondes) für den Zeitraum von 3400 v. Chr. bis 2600 n. Chr. ohne Anwendung der Logarithmen und trigonometrischen Funktionen bis auf ein Zehntel Grad unter besonderer Berücksichtigung der Babylonischen Astronomie. Mit über 100 leicht verständlichen, vollständig durchgeführten Beispielen für alle astronomischen Vorgänge von HAMMURABI bis zum Jahre 1927. Berlin-Pankow, LINSER-Verlag, 1927. ISIS

Thompson, J. Eric. A correlation of the Mayan and European calendars. 22 p. Chicago, Field Museum of Natural History (Publication 241; Anthropological Series, vol. 17, no. 1), 1927. ISIS

24. — PHYSICS

Boutaric, A. La chaleur et le froid. 284 p., 68 fig. Paris, ERNEST FLAMMARION, 1927. ISIS

Dans cet ouvrage qui rappellera à beaucoup de ses lecteurs une partie du cours de physique qu'ils avaient appris dans leur jeunesse, et qui intéressera les autres à la physique de la chaleur et du froid M. BOUTARIC a essayé et a réussi à expliquer sans aucun appareil mathématique comment les savants d'autrefois et d'aujourd'hui ont abordé les problèmes théoriques et pratiques soulevés par la thermométrie, la calorimétrie, les changements d'état physique des corps, les basses et hautes températures, la propagation de la chaleur, sa nature et le principe de CARNOT. Un dernier chapitre est consacré à une tentative de mise au point de la discussion récente et encore actuelle soulevée par l'apparente incompatibilité de l'énergétique et de l'atomistique. H. M.

Bray, M. E. J. Gheury de. Published values of the velocity of light.
Nature, 120, 404-405, 1927. ISIS

Chwolson, O. D. Lehrbuch der Physik. 3. Aufl. Bd. I, t. 1 : Mechanik und Messmethoden. Vor der Drucklegung durchgesehen von GERHARD SCHMIDT. x + 401 p. Braunschweig, FRIEDR. VIEWEG & SOHN, 1926. ISIS

Crew, Henry. General Physics. 4th edition. xii + 674 pp. New York, The Macmillan Co., 1927. ISIS

This is an admirable statement of the main facts of modern physics. The author is very much interested in the history of physics,—witness, for example, his excellent translation of GALILEO's Dialogues concerning two new Sciences (New York, 1914; *Isis*, 3, 110) and many papers which may be found in our critical bibliographies by means of the indices. It is thus not surprising to find in this textbook a number of brief historical references. The work is divided as follows : mechanics (252 pp.), sound (42 pp.), heat (81 pp.), electricity and magnetism (145 pp.) light and electromagnetic spectrum (124 pp.), structure of matter (12 pp.); the last chapter including a summary of the latest views (at the time of writing!) on atomic structure. An appendix (3 pp.) deals with the historical development of the thermometer. An excellent book!

G. S.

Eddington, Arthur Stanley. Stars and atoms. 127 p., 6 pl. New Haven, Yale University Press, 1927. ISIS

Engelmann, Max. Alte wissenschaftliche Instrumente. Sammlung ANT. W. M. MENSING in Amsterdam. 2 Teile, Text und Abbildungen. Amsterdam, 1924. ISIS

Fürst, Artur. Das elektrische Licht, von den Anfängen bis zur Gegenwart, nebst einer Geschichte der Beleuchtung. 222 p., 136 fig. München, ALBERT LANGEN, 1926. ISIS

Lorentz, Hendrik Antoon. Problems of modern physics : a course of lectures delivered in the California Institute of Technology. Edited by H. BATEMAN. vi + 312 p. Boston, GINN and Co., 1927. ISIS

Weve, H. Over brillenaafbeeldingen in de plastische kunst. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 558-570, 6 fig., 1927. ISIS
Representations of spectacles.

Wien, W. u. Harms, F. (edit.). Handbuch der Experimentalphysik. Bd. I. Mess-Methoden und Mess-Technik, von LUDWIG HOLBORN; Technik des Experiments, von ERNST VON ANGERER. xx + 484 S., 246 Abb., 1 Taf. Bd. II. Mechanik der Massenpunkte und der

starken Körper von PHIL. ARTHUR HAAS. XIV + 356 S., 236 Abb. Akad. Verlagsgesellsch., Leipzig, 1926. ISIS

Si l'on en juge par la liste des cinquante collaborateurs qu'ont su grouper autour d'eux W. WIEN et F. HARMS, et par l'ampleur des deux premiers volumes parus, où sont traitées les méthodes et la technique des mesures, la technique des manipulations auxquelles doit pouvoir se livrer couramment un physicien, la mécanique du point matériel, la mécanique des systèmes rigides (avec des compléments mathématiques sur la mécanique des solides), ce traité de physique formera une œuvre énorme, égale en ampleur au traité de BOUASSE, mais où chaque partie sera traitée par un spécialiste, alors que le physicien de Toulouse assume à peu près tout seul la tâche. Comme dans le BOUASSE (*Isis*, 7, 315, 325, 594.) si l'on en croit ces deux volumes qui corroborent l'annonce faite par les éditeurs dans leur très courte préface, la physique théorique ne sera envisagée que lorsqu'elle sera nécessaire à la compréhension des faits expérimentaux; quant aux renseignements historiques, ils sont relégués plus loin même qu'à l'arrière-plan. L. G.

25. — CHEMISTRY, PHYSICO-CHEMISTRY, INDUSTRIAL CHEMISTRY.

Carbonelli, Giovanni. Sulle fonti storiche della chimica e dell'alchimia in Italia. Tratte dallo spoglio dei Manoscritti delle Biblioteche con speciale riguardo ai codici 74 di Pavia e 1166 Laurenziano. Opera corredata di 242 riproduzioni fotografiche e due tavole fuori testo. XX + 210 p. Roma, Istit. naz. med. farmacologico, 1925. ISIS

Reviewed by K. SUDHOFF, *Mitteilungen zur Geschichte der Medizin und der Naturwissenschaften*, 26, 261-262, 1927.

Catalogue des manuscrits alchimiques grecs, publié sous la direction de J. BIDEZ, F. CUMONT, A. DELATTE, J. L. HEIBERG, et O. LAGERCRANTZ. II : Les manuscrits italiens décrits par C. O. ZURETTI, avec la collaboration de O. LAGERCRANTZ, J. L. HEIBERG, I. HAMMER-JENSEN, D. BASSI et AE. MARTINI. VI + 368 pp. Bruxelles, LAMERTIN, 1927. ISIS

I gave a long account of this publication of the International Academic Union when parts I and III appeared (1924; *Isis*, 7, 507-511). It is not necessary to insist upon its importance; it is truly fundamental. The present volume contains descriptions of the two old Marciani (no. 299 by OTTO LAGERCRANTZ; no. 598 by J. L. HEIBERG; this covers not less than 37 pp.); of a large Laurentian MS. written in 1492 by ANTONIO DRANGANAS; of a Vatican MS. (no. 1174) and one Ottobonianus by I. HAMMER-JENSEN; the MSS of the Ambrosiana, of Venice and Bologna, of the Vatican and other Roman libraries are described by C. O. ZURETTI, and the Neapolitan by AE. MARTINI and D. BASSI. This is followed by a description of all of the Libri Koeranidum (Venice, Milan, Bologna, Florence) by C. O. ZURETTI (pp. 263-331), by a number of extracts edited by HEIBERG and ZURETTI (pp. 332-340), and by a comparative study of Parisinus 2327 with Marcianus 299 by LAGERCRANTZ, (These MSS are

independent and the former represents sometimes an older tradition), and last but not least by elaborate indices compiled by MARIE DELCOURT. The lion share of this volume was thus contributed by CARLO ORESTE ZURETTI, professor at the University of Milan. It is interesting to note that he is preparing an edition of the Vaticanus 1134, a MS. dated Reggio Calabria, 1376, which is perhaps as important as the old Marcianus 299 (Bessarion's MS.); see his preliminary note in LIPPMANN's *Festschrift* (pp. 55-77; *Isis*, 10, 135). G. S.

Haas, Arthur Erich. Atomic theory: an elementary exposition. Translated by T. VERSCHOYLE. XIV + 222 p. London, CONSTABLE, 1927. ISIS

Hedges, Ernest Sydney and Meyers, J. E. The problem of physico-chemical periodicity. With a foreword by F. G. DONNAN. 95 p., 2 pl. London, ARNOLD, 1926. ISIS
Reviewed by IRVINE MASSON, *Nature*, 119, 267-269, 1927.

Patterson, T. S. The late professor JOHN FERGUSON, (1837-1916). Reprinted, with some alterations, from the *Glasgow University Magazine*, Dec. 6, 1916, 16 p. ISIS

Ponsinet, Jules. Principes d'électrochimie. 216 p. *Collection Armand Colin*, Paris, COLIN, 1927. ISIS

Exposé clair des lois de l'électrochimie, fait en partant de l'hypothèse de la dissociation en ions des électrolytes. (Les réactions électrochimiques dans lesquelles le courant agit uniquement par ses effets calorifiques sont laissées de côté). Un chapitre est réservé aux concentrations en ions H, et à la mesure des P_H qui joue un rôle de plus en plus important en chimie et en biologie. Les applications ne sont qu'indiquées, comme illustration sommaire des lois. L. G.

Van Gelder, Arthur Pine and Schlatter, Hugo. History of the explosives industry in America. (Prepared from data collected by and published under the direction of the Institute of Makers of Explosives). With an introduction by CHARLES E. MUNROE. XXXVIII + 1132 p. New York, Columbia University Press, 1927. ISIS

Walden, Paul. Von der Iatrochemie zur « organischen Chemie ». Historisches über Entstehung und Namenbildung der « organischen Chemie ». *Z. f. angew. Chemie*, 40, 1-16, 1927. ISIS

Reviewed by PAUL DIERGART, *Mitt. zur Geschichte der Medizin*, 26, 182, 1927.

26. — TECHNOLOGY.

(For mining, see 32, geology; for industrial chemistry, 25, chemistry.)

See also *Arts and Crafts*, under 45.)

Alibaux, Henri. Les premières papeteries françaises. Paris, Les arts et le livre, 1926. ISIS

Bassermann-Jordan, Ernst von. Alte Uhren und ihre Meister. VIII + 179 p., 164 Abb., 8 farbige Tafeln, Bildniss. Leipzig, DIEBENER, 1926. ISIS

Blind, Adolphe. Les automates truqués. Genève, EGGIMANN, 1927. ISIS

Reviewed by F. M. FELDHAUS, *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 202, 1927.

Buckley, Wilfred. European glass; a brief outline of the history of glass making, with notes on various methods of glass decoration, illustrated by examples in the collection of the author. With a foreword by BERNARD RACKHAM, and with an essay on Dutch glass engravers by FERRAND HUDIG. XXXIV + 96 p., 104 pl. (Printed in Great Britain). Boston, HOUGHTON MIFFLIN, 1926. ISIS

Dick, Otto. Die Feile und ihre Entwicklungsgeschichte. 251 S., 278 Abb. Berlin, SPRINGER, 1925. ISIS

Feldhaus, Franz M. Ein Buch über die Leistungen der Techniker und Erfinder. *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 13-22, 1927. ISIS

Feldhaus, Franz M. « Geschichte der Technik. » *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 1-5, 1927. ISIS

Announcing the creation of a society bearing that name, in Berlin, Febr. 18, 1927. « Der Zweck des Vereins ist die Verbreitung von Kenntnissen aus der Geschichte der Technik und Industrie wie auch Erwerb und Ausbau des von mir gesammelten Quellenmaterials zur Geschichte der Technik und Industrie. »

Feldhaus, Franz M. Die Sammlungen FELDHAUS und ihr neues Heim. *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 6-10, 4 Abb., 1927. ISIS

Hartley, F. St. A. Electrical engineering. (Catalogue of the collections in the Science Museum, South Kensington, with descriptive and historical notes and illustrations.) 116 p., 14 plates. London, H. M. Stationery Office, 1927. (not seen). ISIS

Horwitz, Hugo Th. Systematik und Oekonomie bei technisch geschichtlicher Forschung. *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 23-26, 1927. ISIS

Johannsen, Otto. Geschichte des Eisens. Zweite Auflage. VII + 248 p., 222 fig. Düsseldorf, Verlag Stahleisen, 1925. ISIS

Reviewed by H. TH. HORWITZ, *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 199-201, 1927. First edition 1924 (*Isis*, 8, 617).

Leclerc, Emile et autres. Les transformations du papier et du carton. 160 pp. 270 x 220, nombr. illustr., Les publications Papyrus, Paris, 1926. ISIS

Cette belle publication, éditée par la revue *Papyrus* sur beau papier, et dont l'illustration est extrêmement soignée, est formée de courtes monographies écrites par des spécialistes du papier, de l'édition, de la reliure et du carton. J'y note surtout une causerie sur le papier, de EMILE LECLERC; des considérations sur les principales sortes de papier d'édition, leur utilisation dans les divers procédés et leurs caractéristiques, de JACQUES CROLARD; des études de : RENÉE DUNAN sur les éditions jusqu'au milieu du XVII^e s., avec des reproductions parfaitement venues; de JOSEPH TAUPIN sur la fabrication mécanique du livre; de EDMOND ROCHER sur l'art de la décoration dans la reliure moderne, et une note d'après F. FOLLOR sur les origines et l'histoire du papier peint (les premiers essais faits en Europe remontent à la seconde moitié du XVI^e s.; la première fabrique est celle de LE FRANÇOIS de Rouen, 1610). L. G.

Lefebvre des Noettes, Commandant, et Bloch, Marc. La force motrice animale et le rôle des inventions techniques. *Revue de Synthèse Historique*, 43, 83-91, 1927. ISIS

Luckiesh, Matthew. Contributions of science to the lighting art. *Science*, 65, 531-535, 1927. ISIS

Marsh, W. Lockwood. Aeronautical prints and drawings. xx + 36 p., 87 plates. London, HALTON & TRUSCOTT SMITH, 1924. ISIS
Reviewed by HANS W. SINGER in *Deutsche Literaturzeitung*, 1116-1117, 1927.

Mori, Gustav. Das Schriftgiessergewerbe in Süddeutschland und den angrenzenden Ländern. Ein Abschnitt aus der Geschichte des deutschen Schriftgiesser-gewerbe. xx + 76 p., plates and portraits. Stuttgart, Schriftgiesserei BAUER & Co., 1924. ISIS

IV. BIOLOGICAL SCIENCES

(Knowledge of organic nature).

27. — BIOLOGY

(Generalities, « Natural History ».)

Bertalanfy, Ludwig von. Das Problem des Lebens. *Scientia*, 41, 265-74, 1927; trad. franç., *id.* suppl., 117-125. ISIS

La conception mécaniste de la vie ne suffit pas; insuffisantes aussi les expli-

cations vitalistes. La théorie biologique de RIGNANO seule permet actuellement d'ordonner les faits biologiques (p. 249). L. G.

Brachet, A. La vie créatrice des formes (*Nouvelle collection scientifique*). 200 p., 29 fig. Paris, F. ALCAN, 1927. ISIS

Goldschmidt, Richard. Physiologische Theorie der Vererbung. VI + 247 p. Berlin, SPRINGER, 1927. ISIS

Reviewed by J. S. HUXLEY, *Nature*, 120, 109-111, 1927.

Jennings, Herbert Spencer. Vie et mort. Hérité et évolution chez les organismes unicellulaires. Trad. de l'anglais par M. FRANÇOIS-PÉREY. 276 p., 53 fig., FÉLIX ALCAN, Paris, 1927. ISIS

« Cet ouvrage n'est pas une étude de protozoologie, mais de génétique dans laquelle les protozoaires ont servi de matériel d'expérience, et dont les résultats ont été comparés à ceux que l'on connaissait pour les animaux supérieurs... Ce travail traite de l'hérédité, de la variation, de l'évolution au point de vue physiologique, et non historiquement. Il discute du présent et non de ce qui a pu se passer auparavant ». Le texte primitif (l'édition américaine est de 1920) a été revu par l'auteur, et mis au courant des travaux récents, en vue de cette traduction française. L. G.

Lillie, Ralph S. Physical indeterminism and vital action. *Science*, 66, 139-144, 1927. ISIS

MacLeod, Julius (1857-1919). The quantitative method in biology. (Publication of the University of Manchester, Biological series, no. 2). 2d ed., with a memoir of the author and a list of his scientific writings. XXIII + 228 p., illust. Manchester, University Press, 1926. ISIS

Meyer, Adolf. Logik der Morphologie : im Rahmen einer Logik der gesamten Biologie. VII + 290 p. Berlin, JULIUS SPRINGER, 1926. ISIS

Mitchell, P. Chalmers. Logic and law in biology. *Nature*, 119, 748-750, 1927. ISIS

HUXLEY memorial lecture delivered at the Imperial College of Science and Technology, South Kensington, May 4, 1927.

Patten, Charles Joseph. The memory factor in biology : a sketch of the unity of life. XIII + 175 p. London, BAILLIÈRE, TINDALL and Cox, 1926. ISIS

Reviewed by E. S. R. in *Nature*, 119, 741, 1927.

Pearl, Raymond. The biology of population growth. XIV + 260 p. London, WILLIAMS and NORGATE, 1926. ISIS

Reviewed by A. B. HILL in *Nature*, 120, 394-96, 1927.

Przibram, Hans. Die anorganischen Grenzgebiete der Biologie (insbesondere der Kristallvergleich). (*Sammlung Borntraeger*, Band 10.) 240 p. Berlin, Gebrüder BORNTRAEGER, 1926. ISIS

Reviewed by E. W. M. in *Nature*, 119, 738-740, 1927.

Rignano, Eugenio. Qu'est-ce que la vie ? Nouveaux essais de synthèse biologique. 208 p. Paris, ALCAN, 1926. ISIS

L'auteur a groupé sous ce titre ses études parues dans *Scientia*, t. 38 et 39 (1925 et 1926), dont j'ai précédemment indiqué le contenu (*Isis*, 9, 197). Seul est nouveau le chapitre de conclusion intitulé « la place de l'homme dans l'univers et la morale nouvelle de l'harmonie de la vie. » L. G.

Rolleston, Sir Humphry. Concerning Old Age. (Discourse delivered at the Royal Institution, May 13, 1927). Supplement to *Nature*, 120, 2-12, 1927. ISIS

Stiles, Walter. Modern views of the mechanism of carbon assimilation. *Scientia*, 41, 117-126, 1927; trad. franç., *id.*, suppl. 62-70. ISIS

Varigny, Henry de. La mort et la biologie : la mort devant la biologie, les organismes immortels, l'antiquité de la maladie, vieillesse et rajeunissement. 312 p. Paris, FÉLIX ALCAN, 1926. ISIS

Ce volume réunit une série d'essais sur la mort, pour lesquels l'auteur s'est vu attribuer en 1926 le prix Binoux (*Isis*, 8, 161-3, 725; 9, 370-2) pour l'histoire et la philosophie des sciences. D'histoire des sciences, il n'en est pas question dans ce livre; de philosophie des sciences, pas beaucoup plus. Chacun des chapitres, d'ailleurs agréables à lire, fait l'effet d'un bon article de vulgarisation pour une revue destinée au grand public. L. G.

Volterra, Vito. Una teoria matematica sulla lotta per l'esistenza. *Scientia*, 41, 85-102, 1927; trad. franç., *id.* suppl., 33-48. ISIS
Exposé très succinct des travaux de l'auteur.

Weber, Friedl. Neue Wege der Protoplasma-Forschung. *Scientia*, 40, 367-378, 1926; trad. franç., *id.*, suppl., 130-139. ISIS

28. — BOTANY

(*Agronomy, Phytopathology, Palaeobotany.*)

Bidwell, Percy Wells and Falconer, John I. History of agriculture in the northern United States 1620-1860. XII + 512 p., 114 fig., 86 tables. Washington, D. C., Carnegie Institution, 1925. ISIS

The point of view of this compilation is almost exclusively economic. However the historian of botany may have to refer to it to obtain information on the plants cultivated in America. Of course it deals not only with agriculture stricto sensu but with livestock and husbandry in general. It is divided in

four parts : 1. Agriculture in the earliest settlements (unfortunately very short, 62 p.); 2. Rural economy in the eighteenth century (76 p.); 3. Expansion and progress, 1800-40 (110 p.); 4. Northern agriculture, 1840-60. The period of transformation (195 p.). This will interest also the historian of technology, because of the attention paid to the development of agricultural machinery. This study is completed by a classified and critical bibliography, an alphabetical list of the works quoted (725 in number), miscellaneous statistics and an index. There are 114 figures most of which are economic maps. G. S.

Bose, Sir Jagadis Chunder. Plant autographs and their revelations. XIV + 231 p. London, Longmans, GREEN, 1927. ISIS

Reviewed by C. J. PATTEN in *Nature*, 110, 919-920, 1927.

Cohen, Hendrik. Bijdrage tot de geschiedenis der geneeskruidcultuur in Nederland. Proefschrift. XXIII + 251 p., 20 pl. Rotterdam, BRUSSE, 1927. ISIS

Reviewed by M. A. VAN ANDEL, *Bijdragen tot de geschiedenis der geneeskunde*, 7, 375-376, 1927.

Darmstaedter, Ernst. Eisenhärtung mit Pflanzen. *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 163-169, 1927. ISIS

Goblet d'Alviella, Comte. Histoire des bois et forêts en Belgique. Des origines à la fin du régime autrichien. 3 vol. 982 p., 36 pl. Paris, PAUL LECHEVALIER, 1927. ISIS

Reviewed in *Revue générale des Sciences*, 38, 483, 1927.

Guitard, E. H. Les dictionnaires et les traités de botanique. *Bull. soc. hist. de la pharmacie*, 333-344, 4 pl., déc. 1926. ISIS
Guide bibliographique sommaire.

Hahn, Eduard. Die Pflanze als Begleiter der Menschheit. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 54-61, 1927. ISIS

General views on the dawn of agriculture.

Kroeber, Ludwig. « Kräuterbücher » in alter und neuer Zeit. Festschrift für A. TSCHIRSCH, S. 108-120. Leipzig, CHR. H. TAUCHNITZ, 1925. ISIS

Peake, Harold J. E. The beginnings and the early spread of agriculture. *Nature*, 119, 894-896, 1927. ISIS

Rohde, Eleánour Sinclair. Garden-craft in the Bible and other essays. Many illustrations. London, HERBERT JENKINS, 1927. ISIS

Spoehr, Herman Augustus. Photosynthesis. (*American Chemical Society Monograph Series*, No. 29.) pp. 393. New York, The Chemical Catalog Co., 1926. ISIS

Reviewed in *Nature*, 119, 808-809, 1927.

Tupling, George Henry. The economic history of Rossendale. Maps, plans and table. Manchester, University Press, 1927. ISIS

Whitney, Milton. Soil and civilisation : a modern concept of the soil and the historical development of agriculture. (Library of Modern Sciences.) x + 278 p., 5 pl. London, CHAPMAN and HALL, 1926. ISIS
Reviewed by W. E. B. in *Nature*, 120, 436-7, 1927.

Wilson, Ernest Henry. Plant hunting. Two volumes; with 128 illustrations mostly from photographs taken by the author. Boston, Mass., STRATFORD Co., 1927. ISIS

29. — ZOOLOGY.

Ash, Edward C. Dogs : their history and development. 2 vols. With an introduction by the Duchess of Newcastle. vol. 1: xviii + 384 p., 108 pl. Vol. 2 : xvi + p. 385-778, pls. 109-160. London, ERNEST BENN, 1927. ISIS

Bresslau, E., and Ziegler, H. E. Zoologisches Wörterbuch : Erklärung der zoologischen Fachausdrücke; zum Gebrauch beim Studium zoologischer, anatomischer, entwicklungsgeschichtlicher und naturphilosophischer Werke. Revidiert und herausgegeben von H. E. ZIEGLER und E. BRESSLAU. Dritte vermehrte und verbesserte Auflage. viii + 786 p. Jena, GUSTAV FISCHER, 1927. ISIS
Reviewed in *Nature*, 119, 632, 1927.

Garbini, Adriano. Antroponimie ed Omonimie nel campo della zoologia popolare. Parte II : Omonimie. Vol. I. II. (Accad. di Agricoltura, Scienze e Lettere. Vol. fuori serie.) 1598 p. Verona, La Tipografica Veronese, 1925. ISIS
Reviewed by W. MEYER-LÜBKE, *Deutsche Literaturzeitung*, 502-503, 1927.

Hirsch-Schweigger, Erwin. Zoologisches Wörterbuch. (Veit's Sammlung Wissenschaftlicher Wörterbücher). viii + 628 p., 477 fig. Berlin, WALTER DE GRUYTER, 1925. ISIS

Horwitz, Hugo Th. Über den Gebrauch von Werkzeugen im Tierreich. *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 26-29, 1927. ISIS

Jenkins, James Travis. The herring and the herring fisheries. London, KING, 1927. ISIS

Kraemer, Hermann. Der Artbegriff in Anwendung auf die Haustiere. *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 62-71, 1927. ISIS

Maeterlinck, Maurice. La vie des termites. 219 p., 1 fig. Paris, FASQUELLE, 1926. ISIS

Étude bien documentée qui continue en quelque sorte l'enquête commencée dans « la vie des abeilles » il y a tant d'années. Dans les derniers chapitres : Les destinées, l'instinct et l'intelligence, l'auteur essaye d'en dégager les leçons, mais il n'aboutit qu'à reconnaître un insondable mystère. « Ma conclusion c'est qu'il faut apprendre à accepter notre ignorance des choses essentielles, et devenir plus humble. C'est ce que font les savants, mais les philosophes l'oublient trop souvent. » G. S.

Pavlovskii, E. N. Gifttiere und ihre Giftigkeit. XVI + 516 p., 176 illustrations. Jena, GUSTAV FISCHER, 1927. ISIS

Rudy, Hermann. Die Wanderheuschrecke, *Locusta migratoria* L. *phasa migratoria* L. et *phasa danica* L. Beiträge zu einer Monographie. *Badische Blätter für Schädlingsbekämpfung*. 34 S., 3 Taf., Freiburg i. Br., 1925. ISIS

V. SCIENCES OF THE EARTH

(implying knowledge of both organic and inorganic nature.)

30. — GEODESY.

Bowie, William. Isostasy. xv + 275 p., 39 illustrations. New York, E. P. DUTTON, 1927. (five dollars). ISIS

This general review of isostasy and connected problems hardly needs commendation. The author is one of the world authorities on the subject. Since 1909 he has continued the work of JOHN F. HAYFORD in the service of the U. S. Coast and Geodetic Survey. Leaving aside vague ideas, or even more definite suggestions, such as those made by BABBAGE and HERSCHIFF at the beginning of the last century, we may say that this new branch of science (one connecting geology and geodesy) was born in 1855 (G. B. AIRY, *Philos. Trans.*, 145, 101). AIRY was followed by J. H. PRATT. The two fundamental isostatic theories are called after these two men : PRATT's theory postulates that the earth's crust extends to a certain depth below sea level, with varying densities of crustal material under elevations and depressions ; on the contrary AIRY's theory postulates that the crustal matter has uniform density with varying thicknesses. The author is convinced that PRATT's view is the right one, but AIRY's view is not entirely abandoned, e.g. WEGENER favors it. The American C. E. DUTTON read in Washington, as early as 1871, a paper

on the causes of regional elevations and subsidence, which was truly prophetic. He must be counted one of the founders of isostasy. HAYFORD's and BOWIE's investigations were the first to give a quantitative proof of the new theory; their conclusions based upon American evidence were admirably confirmed by SIDNEY BURRARD, using Hindu material. BOWIE's survey is divided as follows: 1. The development of the isostatic theory; 2. Quantitative test of isostatic theory; 3. Assumptions underlying computations of isostatic effect; 4. Isostatic condition of earth's crust under various classes of terrain; 5. Some geodetic and geophysical deductions from the proof of isostasy; 6. Some phases of isostatic adjustment; 7. The influence of isostasy on geological deductions; 8. Processes involved in crustal and subcrustal movements; 9. Proposed theory, in harmony with isostasy, to account for major changes in the elevation of the earth's surface. G. S.

31. — GEOGRAPHY and OCEANOGRAPHY.

Chubb, Thomas. The printed maps in the atlases of Great Britain and Ireland. A bibliography, 1597-1870. With an introduction by F. P. SPRENT, and biographical notes on the map makers, engravers, and publishers. 479 p. London, Homeland Association, 1927. ISIS

Dreyer, A. Bücherverzeichnis der Alpenvereinsbücherei mit Verfasser- und Bergnamenverzeichnis. Hrsg. vom Hauptausschuss des deutschen und österreichischen Alpenvereins und vom Verein der Freunde der Alpenvereinsbücherei. XVI + 1358 Sp. München, K. LINDAUER, 1927. ISIS

Reviewed by EUGEN WEBER, *Deutsche Literaturzeitung*, 1622-23, 1927.

Fite, Emerson D. and Freeman, Archibald. A book of old maps, delineating American history from the earliest days down to the close of the revolutionary war. XVI + 299 p. Cambridge, Mass., Harvard University Press, 1927. ISIS

Fitzgerald, Walter. The historical geography of early Ireland. With an introduction by PERCY M. ROXBY. (*The Geographical Teacher*, Supplement No. 1.) VII + 100 p., illustrated. London, GEORGE PHILIP, 1926. ISIS

Hettner, Alfred. Die Geographie: ihre Geschichte, ihr Wesen und ihre Methoden. VIII + 463 p. Breslau, FERDINAND HIRT, 1927. ISIS

Martin, Lawrence. Noteworthy maps with charts, views and atlases. Accessions for the fiscal year ending June 30, 1926. (Library of Congress, division of maps.) 28 p. Washington, D. C., Government printing office, 1927. ISIS

- Rouch, Jules.** Les régions polaires. (*Nouvelle Collection scientifique.*) Paris, Alcan, 1927. ISIS

32. — GEOLOGY, MINERALOGY, PALAEONTOLOGY, MINING.

(For palaeobotany, palaeozoology and palaeoanthropology, see respectively 28. botany, 29. zoology, and 39. prehistory.)

- Allen, R. C. and Martin, Helen M.** A brief history of the geological and biological survey of Michigan. 1837 to 1872 by R. C. ALLEN; 1872 to 1920 by HELEN M. MARTIN. *Michigan Hist. Mag.*, 6, 675-750, 3 portraits, 1922. ISIS

- Davison, Charles.** The Founders of Seismology. xiv + 240 p. Cambridge, University Press, 1927. ISIS

This account of the history of seismology, by one of the most expert students of the subject, is very elaborate and apparently very accurate. It is divided as follows: 1. Before MICHELL: JOHN BEVIS, ELIE BERTRAND; 2. JOHN MICHELL; 3. From MICHELL to PERREY; 4. ALEXIS PERREY; 5. ROBERT MALLET and his successors; 6. The study of earthquakes in Italy; 7. The study of earthquakes in Central Europe; 8. The study of earthquakes in the United States; 9. FERNAND DE MONTESSUS DE BALLORE; 10. JOHN MILNE; 11. FUSAKICHI OMORI.

The biographies of the main protagonists are brief but sufficient, and the analysis of their contributions is very clear and well ordered, with references to the papers wherein they occur. Our only regret is the absence of a few portraits; this would not have increased considerably the cost of the book and would have made it much more attractive. A previous historical study by the same author, *A History of British Earthquakes*, Cambridge, 1924, was reviewed in *Isis*, 8, 628. G. S.

- Gattefossé, Jean et Roux, Claudius.** Bibliographie de l'Atlantide et des questions connexes, (géographie, ethnographie et migrations anciennes. Atlantique et Méditerranée, Afrique et Amérique, fixité ou dérive des continents, déluges, traditions, etc.). III p., avec 15 planches de cartes et croquis. Lyon, BOSC et RIOU, 1926. ISIS

- Groth, Paul.** Entwicklungsgeschichte der mineralogischen Wissenschaften. IV + 262 S., 5 Textfig. Berlin, SPRINGER, 1926. ISIS

Reviewed by ARRIEN JOHNSEN, *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, 10, 367-368, 1927.

- Perkins, George Henry.** History and summary of geological work in Vermont, 1810-1923. Vermont, State Geologist, 13th Report (1921-1922), 1-70, 1923. ISIS

- Wegener, Alfred.** Die geophysikalischen Grundlagen der Theorie der

Kontinentenverschiebung. *Scientia*, 41, 103-116, 1927; trad. franç., *id.*, suppl., 49-61. ISIS

Examen des preuves apportées par la géophysique à l'appui de la théorie de la dérive des continents (Die Entstehung der Kontinente und Ozeane, 3^e Aufl., 1922; *Isis*, 6, 223), par les faits d'isostasie, les connaissances sur la nature du sol de la haute mer, ce que l'on sait de la viscosité de la terre, et ce que l'on peut attendre de déterminations précises et répétées de la longitude du Groenland. L. G.

33. — METEOROLOGY, CLIMATOLOGY and TERRESTRIAL PHYSICS.

Shaw, Sir Napier. Manual of meteorology. Vol. I: Meteorology in history. With the assistance of ELAINE AUSTIN. xx + 339 p., 18 pl. Cambridge, University Press, 1926. ISIS

Reviewed by W. H. DINES, *Nature*, 119, 915-17, 1927.

VI. ANTHROPOLOGICAL AND HISTORICAL SCIENCES (Knowledge of man, past and present).

34. — ANATOMY.

Capparoni, Pietro. La persistenza delle forme degli antichi « donaria » anatomici negli « ex voto » moderni. *Bolletino dell'Istituto storico italiano dell' arte sanitaria*, p. 39-57, 38 fig., Roma, 1927. ISIS

Lint, J. G. de. Atlas of the history of medicine. I. Anatomy. With a foreword by CHARLES SINGER. 96 p. New York, PAUL B. HOEBER, 1926. ISIS

Chronological series of 199 pictures, with supplementary notes, illustrating the development of anatomy from Babylonian times to HUGO DE VRIES. Naturally richest in Dutch material. In a picture book history of this sort, caution is required in arranging the size of the illustrations, so that the uninitiated will not get a wrong prospective. One might get an entirely erroneous idea of the relative importance of the contributors to the science, when one finds a full page devoted to CORNELIUS VAN 'S-GRAVEZANDE (1631-1691), who contributed practically nothing to the subject, and only a quarter page to MARCELLO MALPIGHI (1628-1694) who was one of the greatest of the microscopists. It is surprising in view of SPIELMANN's critique to note the doubtful portrait of VESALIUS first described by DANIELS. Is there no pictorial representation of EUSTACHIUS extant? The expert would have appreciated mention of the source of many of the pictures. Dr. SINGER's Foreword includes some interesting philosophical considerations. The book is marred by a profusion of irritating typographical errors, not to be expected from HOEBER, and by the lack of an index. C. D. L.

Masson, Louis. Les papes et la dissection. *Aesculape*, 121-4, mai, 1927. ISIS

Commentaire approbatif sur un travail de G. MARTINOTTI, dont le titre n'est pas donné. Contrairement à l'opinion maintes fois exprimée, l'église n'aurait jamais entravé la dissection des cadavres humains; la bulle de BONIFACE VIII (1299) n'aurait eu d'autre but que de régulariser les moyens de se procurer des cadavres. L. G.

35. — PHYSICAL ANTHROPOLOGY.

(*Anthropometry and races of man*).

Haddon, Alfred Cort. Les races humaines et leur répartition géographique. Traduit par A. VAN GENNEP. xv + 327 p., 12 pl. Paris, FÉLIX ALCAN, 1927. ISIS

English editions, London, MILNER, 1909; New York, MACMILLAN, 1925.

Nijessen, D. J. H. De nederlandsche arts als anthropoloog. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 602-613, portraits, 1927. ISIS

Pitt-Rivers, George Henry Lane-Fox. The clash of culture and the contact of races: an anthropological and psychological study of the laws of racial adaptability, with special reference to the depopulation of the Pacific and the government of subject races. xiv + 312 p. London, GEORGE ROUTLEDGE, 1927. ISIS

Roberts, Stephen Henry. Population problems of the Pacific. xx + 411 p. London, ROUTLEDGE, 1927. ISIS

Schmidt, Max (1874-). The primitive races of mankind, a study in ethnology. Translated by ALEXANDER K. DALLAS. 360 p., 80 pls., maps. London, HARRAP, 1926. ISIS

Taylor, Griffith. Environment and race. A study of the evolution, migration, settlement and status of the races of man. 372 p., 6 pl., 93 fig. in text. New York, Oxford University Press (American Branch), 1927. ISIS

36. — PHYSIOLOGY.

(*human and comparative*).

Fulton, John Farquhar, jr. Muscular contraction and the reflex control of movement. xv + 644 p., illus. Baltimore, WILLIAM and WILKINS, 1926. ISIS

Reviewed in *Nature*, 120, 437-8, 1927.

37. — PSYCHOLOGY.

(human and comparative).

Bertrand-Barraud, Daniel. De la nature affective de la conscience.

156 p. Paris, J. VRIN, 1927.

ISIS

Ce petit volume, formé de « six leçons de psychologie concrète » professées à la faculté des lettres de Bordeaux en 1925-6 reprend et complète les idées antérieurement exposées par l'auteur. Les valeurs affectives et l'exercice discursif de la pensée, essai d'empirisme psychologique radical; Des bases d'un empirisme psychologique radical (*Isis*, 10, 290).

L. G.

Geley, Gustave. Clairvoyance and materialisation; a record of experiments. Translated by STANLEY DE BRATH. XVI + 401 p., 51 pl. London, FISHER UNWIN, 1927.

ISIS

Reviewed in *Nature*, 120, 111-112, 1927.

Leyacker, Josef. Zur Entstehung der Lehre von den Hirnventrikeln als Sitz psychischer Vermögen. *Archiv für Geschichte der Medizin*, 19, 253-286, 1927.

ISIS

Rignano, Eugenio. Le congrès international de psychologie de Groningue. *Scientia*, 41, 127-150, 1927.

ISIS

Note critique sur les travaux présentés à ce VIII^e congrès, tenu à Groningue en 1926, congrès vraiment international, celui-ci.

L. G.

Roback, A. A. A bibliography of character and personality. 340 p. Cambridge, Mass., Sci-art publishers, 1927.

ISIS

This bibliography, containing more than three thousand titles, has the great advantage of having been prepared, not by a bibliographer, but by a student of the subject; i.e. not merely from the outside, but from the inside. Indeed ROBACK's own book, *Psychology of character* (London, KEGAN PAUL, 1927) is one of the main contributions to this important branch of psychology. The bibliography is arranged alphabetically by authors, but is followed by a classification of titles according to point of view, by lists of periodicals and institutions, and by a chronological appendix. I only regret the paucity of critical notes which the author could have easily added at least to some of the titles. As it is, this bibliography is essentially superior to the one published by GRACE E. MANSON in the Reprint and Circular series of the National Research Council (60 p., Washington, D. C., 1926).

G. S.

38. — ARCHAEOLOGY

(Generalities, methods).

Macalister, Robert Alexander Stewart. A century of excavation in Palestine. 335 p., 36 pl., ill., London, Religious Tract Society, 1926.

ISIS

39. — PREHISTORY.

Ebert, Max (*editor*). Vorgeschichtliches Jahrbuch für die Gesellschaft für vorgeschichtliche Forschung. Band II : Bibliographie des Jahres 1925 mit sechs Tafeln und einer Abbildung im Text. 344 p. Berlin, WALTER DE GRUYTER, 1926. ISIS

Reviewed by GEORGE GRANT MCCURDY, in *Science*, 65, 527, 1927.

Evans, William. The Meini Hirion and sarns of Anglesey. (Considered in relation to the early Hundred System). 53 p. Author : Pen-y-Bont, Red Wharf Bay, Anglesey. ISIS

Jones, Neville. The stone age in Rhodesia. XIV + 120 p., 22 pl. London, Oxford, University Press, 1926. ISIS

Reviewed by HENRY BALFOUR, *Nature*, 119, 226-228, 1927.

Merhart, Gero von. Bronzezeit am Jenissei : ein Beitrag zur Urgeschichte Sibiriens. 190 p., 12 pl. Wien, ANTON SCHROLL, 1926. ISIS

Reviewed by M. C. BURKITT in *Nature*, 119, 775-776, 1927.

Mötefindt, Hugo. Ein buntes Gewebe aus dem prähistorischen Salzbergwerk auf dem Dürrnberg bei Hallein. *Geschichtsblätter für Technik, Industrie und Gewerbe*, 11, 191-193, 1927. ISIS

40. — ETHNOLOGY.

(*Primitive and popular science*).

Bakker, C. Volksgeneeskundige aantekeningen in en om Broek in Waterland verzameld. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 356-369, 1927. ISIS

Fettweis, E. Das Rechnen der Naturvölker. IV + 96 p., map. Leipzig, B. G. TEUBNER, 1927. ISIS

Dies ist die erste derartige Arbeit, die auf grund aller ethnographischen und linguistischen Quellen das vorgesetzte Thema untersucht. Der Verfasser hat eine Literatur von etwa 240 Einzelschriften angegeben, die er in den Fußnoten mit Seitenzahlen zitiert. Die Schrift hat folgende Kapitel : 1. Ansatzmöglichkeiten für die Entwicklung der Rechenkunst; 2. Rechnen mit und ohne Anschauungsmittel, Ziffernsysteme; 3. Zählgruppen und Zählreihen; 4. Zählgesten; 5. Ausführung längerer Rechnungen, Bruchrechnung; 6. Zahlworte, Zahlwortreihen; 7. Der Sinn der Zahlworte; 8. Rechenunterricht usw. Man lernt aber aus der Schrift nicht nur eine Menge bisher völlig verstreut gewesener Einzelheiten, sondern kann auch mehrere allgemeine Züge daraus entnehmen. Z. B. den, dass die Völker meist deswegen nicht weiter kommen in ihrem Zahlbereich oder in ihrer Rechenfertigkeit, weil

dazu kein Bedürfnis vorliegt. Man erfährt, dasz es auch mystische Hemmungen gibt. Man erkennt, dasz primitive Völker jedes unpraktische Rechenbeispiel als unmöglich oder unverständlich ablehnen. Man sieht dasz Zahlwörter fehlen können, während die Begriffe der Zahlen und die Fertigkeit mit ihnen zu rechnen, doch vorhanden ist. Es gibt alle möglichen Zahlensysteme vom zer-System bis zum 40er-System, mit vielfältigen Unregelmäßigkeiten. Sehr bemerkenswert sind auch die Folgerungen, die der Verfasser für den modernen Rechenunterricht aus diesen Erfahrungen zieht. Sie stimmen mit dem, was die heutige Psychologie sagt, durchaus überein.

H. W.

Folmer, H. R. Volksgebruiken in Zeeland bij geboorte en kraambed. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 377-383, 1927. ISIS

Imbelloni, J. La Esfinge Indiana : antiguos y nuevos aspectos del problema de los orígenes americanos. 399 p., 19 pl. Buenos Aires : Librería El Ateneo, 1926. ISIS

Reviewed by G. ELLIOT SMITH, *Nature*, 119, 3-5, 1927.

Karsten, Rafael. The civilization of the South American Indians : with special reference to magic and religion. (*The History of Civilization Series*). XXXII + 540 p. London, KEGAN PAUL, 1926. ISIS

Reviewed in *Nature*, 119, 921, 1927.

Leroy, Olivier. La raison primitive. Essai de réfutation de la théorie du prélogisme. 316 p., 23 illus., dont 15 pl. hors-texte. Paris, GEUTHNER, 1927 (60 frs.) ISIS

Ouvre de polémique contre les ouvrages de LÉVY-BRUHL sur la mentalité primitive, ouvrages bien connus de nos lecteurs (*Isis*, 5 467; 9, 482). LÉVY-BRUHL s'est efforcé d'établir sa théorie du prélogisme inductivement, à l'aide d'un grand nombre d'exemples. LEROY procède de même pour détruire cette théorie. Je dois avouer que la théorie du prélogisme me déplaît en ce qu'elle crée dans l'humanité une discontinuité qui me paraît artificielle. Je n'ai guère eu l'occasion d'observer beaucoup de sauvages, mais j'ai eu de très nombreuses occasions d'observer des hommes de science, c'est-à-dire des être humains dont les fonctions mentales sont les plus disciplinées et dont la pensée est censée être aussi logique que possible. Or j'ai été souvent affligé de constater que ces hommes de science, si éminents qu'ils soient, sont fort souvent, trop souvent, illogiques, antilogiques, alogiques ou prélogiques. Quand les passions sont en jeu, les gens les plus civilisés se fichent du principe de contradiction avec autant de désinvolture que les sauvages. D'autre part LEROY nous prouve que ceux ci font souvent preuve d'un esprit logique fort remarquable. Donc je ne suis pas tenté de croire avec LÉVY-BRUHL que la pensée primitive soit essentiellement différente de la notre. Je crois qu'il n'y a là qu'une différence de degré. Je recommande vivement aux lecteurs de LÉVY-BRUHL de lire LEROY et vice versa. Pour un autre ouvrage de LEROY, voir *Isis*, 8, 637.

G. S.

Lévy-Bruhl, Lucien. How natives think (Les fonctions mentales dans

les sociétés inférieures). Authorised translation by LILIAN S. CLARE.
392 p. London, GEORGE ALLEN, 1926. ISIS

Reviewed in *Nature*, 119, 700-701, 1927.

Malinowski, Bronislaw. Sex and repression in savage society. (*International Library of Psychology, Philosophy and Scientific Method*).
xv + 285 p. London, KEGAN PAUL, 1927. ISIS

Mason, Gregory. Silver cities of Yucatan. With a preface by H. J. SPINDEN. Illustrated with drawings by Dr. SPINDEN and with photographs; 32 illus., 1 map. xvii + 340 p. London, PUTNAM, 1927. ISIS

Moodie, Roy L. Injuries to the head among the precolumbian Peruvians. (Studies in Paleopathology XXI). *Annals of Medical History*, 9, 277-307, 22 fig. 1927. ISIS

Netolitzky, Fritz. Volkstümliche Blutstillungsmittel und ihre Deutung. *Medizinisch-Pharmazeutische Technik*. Monatsbeilage zu « Biologischer Heilkunst », Februar, 1927, 5 S. Radeburg (Bez. Dresden), 1927. ISIS

Reviewed by MARZELL, *Mitt. zur Geschichte der Medizin*, 26, 277, 1927.

Puckle, Bertram S. Funeral customs : their origin and development. 283 p., illus. London, T. W. LAURIE, 1926. ISIS

Schmidt, Wilhelm, und Koppers, Wilhelm. Völker und Kulturen. I. Teil : Gesellschaft und Wirtschaft der Völker. (Der Mensch aller Zeiten, Natur und Kultur der Völker der Erde, Band 3.) xii + 740 p., 1 map, 30 col. plates, 551 textfigures. Regensburg, JOSEF HABEL, 1924. ISIS

Reviewed by R. THURNWALD, *Deutsche Literaturzeitung*, 1906-1916, 1927.

Wright, Jonathan. The medicine of primitive man. *Medical Life*, 34, 41-46, 87-96, 362-408, 1927. ISIS

41. — SUPERSTITION and OCCULTISM.

Fournier d'Albe, Edmund Edward. Telekinesis and materialisation. *Nature*, 120, 446-448, 1927. ISIS

Klinckowstroem, Graf Carl von. Zur Geschichte der Pseudotelepathie. *Zeitschrift für kritischen Okkultismus*, 3, 9-20, Okt. 1927.

Mager, Henry. Les sourciers et leurs procédés. Troisième édition complètement refondue. xx + 352 p. Paris, DUNOD, 1926. ISIS

First edition 1913; second, 1923 (*Isis*, 6, 248).

Strauss, Heinz Artur. Astrologie. Grundsätzliche Betrachtungen. 76 p. München, KURT WOLFF, 1927. ISIS

Reviewed by K. SUDHOFF, *Mitt. zur Geschichte der Medizin und der Naturwissenschaften*, 26, 253-254, 1927.

Summers, Montague. The history of witchcraft and demonology. London, KEGAN PAUL, 1927. ISIS

Summers, Montague. The geography of witchcraft. London, KEGAN PAUL, 1927. ISIS

42. — ECONOMICS.

(*Economic doctrines and history, Commerce, Transportation and Communications*).

Business Historical Society, Boston, Massachusetts. Incorporated late in 1925. Pamphlet of 16 p. explaining aims, and containing list of members. George F. Baker Library, Soldiers Field, Boston, August 1, 1927. ISIS

Helffferich, Karl (1872-1924). Money. Translated from the German by LOUIS INFELD, and edited with an introduction by T. E. GREGORY. Two volumes. London, BENN, 1927. ISIS

Volckmann, Erwin. Germanischer Handel und Verkehr. Synoptische Handelsgeschichte der germanischen Völker (von der Urzeit bis, 1600). VIII + 544 p., 10 fig., maps. Würzburg, MEMMINGER, 1925. ISIS

Reviewed by HERMANN BÄCHTOLD, *Deutsche Literaturzeitung*, 1470-71 1927.

43. — SOCIOLOGY, JURISPRUDENCE and POSITIVE POLITY.

Briffault, Robert. The mothers. A study of the origins of sentiments and institutions. 3 vols. Vol. 1, XIX + 781 p.; vol. 2, XX + 789 p.; vol. 3, XV + 841 p. London, ALLEN and UNWIN, 1927. ISIS

Chénon, Emile. Histoire générale du droit français public et privé des origines à 1815. Vol I. Paris, L. TENIN, 1926. ISIS

Heijnsbergen, P. van. De pijnbank in de Nederlanden. Groningen, P. NOORDHOFF, 1926. ISIS

Holdsworth, William Searle. A history of English law. Volume 9, xxxii + 457 p. London, METHUEN, 1927. ISIS

Kübler, Bernhard. Geschichte des römischen Rechts. Ein Lehrbuch. x + 459 p. Leipzig, A. Deichert'sche Verlagsbuchh., DR. W. SCHOLL, 1925. ISIS

Reviewed by J. BINDER in *Deutsche Literaturzeitung*, 1366-1373, 1927.

Malinowski, Bronislaw. The father in primitive psychology. 93 p. London, KEGAN PAUL, 1927. ISIS

44. — HISTORY of CIVILIZATION.

(*General History, Historical methods, Biography and Chronology.*)

Breasted, James Henry and Robinson, James Harvey. The human adventure. (1) The conquest of civilization, by J. H. BREASTED. xxv + 717 p., 50 plates, 17 maps. (2) The ordeal of civilization: a sketch of the development and world-wide diffusion of our present-day institutions and ideas, by J. H. ROBINSON. xii + 769 p., 59 plates, 12 maps. New York, HARPER and BROS., 1926. ISIS

Reviewed by F. S. MARVIN in *Nature*, 119, 591-593, 1927.

Clark, George Norman. Historical reviewing. Essays in history presented to REGINALD LANE POOLE, p. 115-126, Oxford, 1927. ISIS

Edwards, Lyford Paterson. The natural history of revolution. Chicago University Press, 1927. ISIS

Ehrencron-Müller, Holger. Forfatterlexikon omfattende Danmark, Norge og Island indtil 1814. Bind I-IV. 544 S.; 489 S.; 514 S.; 495 S. Kopenhagen, H. ASCHEHOUG, 1924-27. ISIS

Reviewed by GUSTAV NECKEL, *Deutsche Literaturzeitung*, 1489-91, 1927.

Martin, William. Histoire de la Suisse, essai sur la formation d'une confédération d'états. 319 p. Paris, PAYOT, 1927. ISIS

(**Poole, Reginald Lane**). Essays in history presented to REGINALD LANE POOLE. xiv + 486 p., 4 pl. Oxford University Press, American Branch, New York, 1927 (§ 7). ISIS

Essays dedicated to the late curator of the Bodleian Library, Oxford, on the occasion of his 70th birthday. Some of the essays are mentioned in the present bibliography. It includes a beautiful portrait and a bibliography of his own writings (1876-1926). G. S.

45. — HISTORY of ART.

(Art and science, Iconography, Arts and crafts).

Briggs, Martin Shaw. The architect in history. Oxford, University Press, 1927. ISIS

Hoeber, Otto. An encyclopedia of ironwork. Examples of hand-wrought ironwork from the Middle Ages to the end of the eighteenth century. With an historical introduction. New York, E. WEYHE, 1927. ISIS

Pijoan, José. History of art. Translated by RALPH L. ROYS, with foreword by ROBERT B. HARSHE. Volumes I and II. New York and London, HARPER, 1927. ISIS

46. — HISTORY of LANGUAGE, WRITING and LITERATURE.

Dauzat, Albert. Les noms de lieux, origine et évolution; villes et villages — pays — cours d'eau — montagnes — lieux-dits. VIII + 264 p., illus. Paris, DELAGRAVE, 1926. ISIS

Fitzmaurice-Kelly, James. (1858-1923) A new history of Spanish literature. XVI + 551 p. Oxford, University Press, 1926. ISIS
Reviewed by E. WINKLER in *Deutsche Literaturzeitung*, 909, 1927.

Fitzmaurice-Kelly, James. Spanish bibliography. 389 p. For the Hispanic Society of America. London, MILFORD, 1925. ISIS

Guignon, J. (abbé). L'état actuel du problème d'une langue auxiliaire internationale. *C. R. Acad. des sc. mor. et politiques*, oct.-déc. 1926, 381-399. ISIS

Comparaison entre les différents systèmes proposés, et conclusion en faveur de l'ido. Cette communication de l'abbé GUIGNON est suivie d'observations présentées par CHARLES LYON-CAEN et ANDRÉ LALANDE (p. 400-404). L.G.

Hermannsson, Halldór. Catalogue of the Icelandic collection bequeathed by WILLARD FISKE. (Cornell University Library.) Additions, 1913-1926. IX + 284 p. Ithaca, N. Y., Cornell University, 1927. ISIS

Jónsson, Snaebjörn. A primer of modern Icelandic. VIII + 282 p. Oxford, University Press, 1927. ISIS
Includes readings (p. 123-91) and glossaries (p. 192-282). G. S.

Schmidt, Wilhelm (1868-). Die Sprachfamilien und Sprachenkreise der Erde. (*Kulturgeschichtliche Bibliothek*, herausgegeben von

W. Foy. Reihe 1 : Ethnologische Bibliothek, Band 5). xvi + 596 p.
 Atlas of 14 maps. Heidelberg, C. WINTER, 1926. ISIS
 Reviewed in *Nature*, 120, 288-290, 1927.

47. — HISTORY of MORALS.

(*Moral organization of society*).

Sneath, Elias Hershey. The evolution of ethics. As revealed in the great religions. VIII + 370 p. New Haven, Yale University Press, 1927. ISIS

Souriau, Michel. La fonction pratique de la finalité. *Thèse*. Paris 264 p. Bibl. de philos. contempor., ALCAN, 1925. ISIS

« Nous cherchons une règle ou un ensemble de règles propres à diriger notre conduite;... c'est-à-dire telles qu'il vaille mieux les suivre que non pas... Cette recherche, poursuivie à travers MAINE DE BIRAN (la morale et le moi), KANT (la morale et la raison), RENOUVIER (la morale et la passion), et finalement à travers les données de la psychologie, arrive à cette conclusion : « Il faut m'efforcer en dehors de toute prévention, d'être profondément chrétien. »

L. G.

48. — HISTORY of PHILOSOPHY.

(*See also above 18. Philosophy of Science.*)

Cuvillier, A. Manuel de philosophie (classes de philosophie et de première supérieure). Tome II. Logique — morale — philosophie générale. (Cours de philosophie à l'usage des classes de philosophie et de mathématiques et des classes préparatoires aux grandes écoles). 681 p., 83 fig., 6 tables. Paris ARMAND COLIN, 1927. (32 frs.) ISIS

Ce manuel paraît fort bien renseigné, et la méthode en est intéressante. « On y a cherché à rendre la philosophie attrayante, tant par la clarté de la disposition typographique, par la richesse et l'intérêt des gravures qui accompagnent le texte — c'est, croyons-nous, le premier manuel de philosophie qui soit illustré — que par la forme concrète et vivante donnée à l'exposé de ces problèmes un peu ardue. Toutefois, à l'agrément de la présentation, on s'est efforcé de ne rien sacrifier de la solidité du fond. Tout au contraire, l'ouvrage se recommande par le sérieux de la documentation, la précision du développement, l'abondance des références. Il est au courant des plus récents progrès de la philosophie des sciences et de la métaphysique. Les questions morales s'y trouvent renouvelées par l'utilisation des derniers travaux accomplis en sociologie. Des exercices nombreux, et variés en font un véritable Manuel, c'est-à-dire un instrument de travail qui fait, à chaque instant, appel à la collaboration active de l'étudiant. Enfin — autre innovation — des tableaux synchroniques permettent de se rendre compte de la filiation des doctrines et de leurs rapports avec l'ensemble du développement de la pensée et de l'activité humaines. » Le Tome I : Introduction générale et Psychologie, paraîtra en 1928. U. S.

Cuvillier, A. Cours de philosophie à l'usage des classes de philosophie et de mathématiques et des classes préparatoires aux grandes écoles, IV. Petit vocabulaire de la langue philosophique. 109 p. Paris, ARMAND COLIN, 1925. ISIS

Driesch, Hans. Mind and body. Translated by THEODORE BESTERMAN. London, METHUEN, 1927. ISIS
Third German edition 1923 : *Isis* 6, 234.

Heinemann, Isaak. Die Lehre von der Zweckbestimmung des Menschen im griechisch-römischen Altertum und im jüdischen Mittelalter. 102 p. Breslau, M. & H. MARCUS, 1926. ISIS
Reviewed by JULIUS GUTTMANN, *Deutsche Literaturzeitung*, 1848-50, 1927.

Rutot, A. et Schaerer, Maurice. La formation de la matière minérale. Cohésion, gravitation universelle, affinité, catalyse. 19 p. Bruxelles, H. WELLENS, 1927. ISIS

49. — HISTORY of RELIGION.

(*Religion and Science*).

Beth, Karl. Religion und Magie : ein religionsgeschichtlicher Beitrag zur psychologische Grundlegung der religiösen Prinzipienlehre. Zweite, umgearbeitete Auflage. XII + 433 p. Leipzig, B. G. TEUBNER, 1927. ISIS
First edition under slightly different title, 1914.

Bourdillon, Anne Francis Claudine. The Order of Minoreesses in England. (*British Society of Franciscan Studies*, volume 12). VIII + 107 p. Manchester, University Press, 1926. ISIS

Macpherson, Hector Copland. The church and science : a study of the inter-relation of theological and scientific thought. (*The Living Church Series*). 254 p. London, JAMES CLARKE, 1927. ISIS

Maycock, A. L. The Inquisition from its establishment to the great schism. With an introduction by Father RONALD KNOX. Plates. London, CONSTABLE, 1927. ISIS

Millikan, Robert Andrews. Evolution in science and religion. (Published on the Dwight Harrington Terry Foundation). v + 95 p. New Haven, Yale University Press, 1927. ISIS
Reviewed in *Nature*, 120, 435-436, 1927.

Pallis, Svend Aage. *Mandaean studies.* Oxford, University Press, 1927. ISIS

Original Danish edition, Copenhagen, 1919.

Shipley, Maynard. *The war on modern science: a short history of the fundamentalist attacks on evolution and modernism.* XIV + 415 p. London, KNOPF, 1927. ISIS

VII. MEDICINE.

50. — HISTORY, ORGANIZATION, and PHILOSOPHY of MEDICINE.

Baglioni, Silvestro. *I medici stranieri nella storia della medicina italiana.* Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, 116-119, 1926.

Baur, Marguerite-Louise. *Recherches sur l'histoire de l'anesthésie avant 1846. Inaugural Dissertation zur Erlangung der Doktorwürde der medizinischen Fakultät der Universität Zürich,* *Janus* 31, 89 p., 1927. ISIS

Dana, Charles L. *Peaks of medical history: an outline of the evolution of medicine for the use of medical students and practitioners.* 105 p., 40 pl., 16 illus. New York, PAUL B. HOEBER, 1926. (\$ 3). ISIS

Nicely printed outline, with extravagance in illustration, of medical history. Six « peaks » are noted: HIPPOCRATES, The Alexandrians, GALEN, The Renaissance Period, HARVEY, and JENNER. C. D. L.

Delprat, C. C. *De geschiedenis der nederlandsche geneeskundige tijdschriften van 1680 tot 1857. III. Bijdragen tot de geschiedenis der geneeskunde,* 7, 417-90, 1927. ISIS

Last article of this series, concluding with a chronological list of the 83 Dutch medical journals dealt with. Elaborate study with abundant facsimiles. G. S.

Diller, Theodore. *Pioneer Medicine in Western Pennsylvania.* XIV + 230 pp. 26 full-page illustrations. New York, PAUL B. HOEBER, Inc., 1927. (\$ 3.00) ISIS

An important contribution to the history of American science. It deals with the history of medicine in Pennsylvania, West of the Allegheny Mountains, from the middle of the XVIIIth century to the middle of the XIXth century, and more briefly with subsequent developments down to our days. The early history is closely bound up with military history, for nearly all of the early medical men were military men. Parts of this book have already been quoted in *Isis* as they appeared in the *Annals of Medical History*. G. S.

Liek, Erwin. Der Arzt und seine Sendung; Gedanken eines Ketzers.
2. Aufl. 132 p. München, LEHMANN, 1926. ISIS

Loeb, Leo. Some considerations on certain relations between the history of medicine and general history. *Medical Life*, 34, 168-176, 1927. ISIS

Martin, Alfred. Historical sketch of balneology. *Medical Life*, 34, 256-300, 1927. ISIS
Twenty-three illustrations and short bibliography.

(**Medicine, history. Congress.**) VIe Congrès international d'histoire de la médecine. Catalogue d'une collection d'art medico-historique. Tableaux, portraits, dessins, manuscrits, livres rares et précieux, sculptures, médailles. Exposée, à l'occasion du VIe Congrès international d'histoire de la médecine au Musée Municipal d'Amsterdam. 21 Juillet-1 Août 1927. 123 p., many illustrations, 1927. ISIS

Exposition organisée par B. W. TH. NUYENS, F. M. G. DE FEYFER, I. VAN DER HOEVEN, « exclusivement composée d'œuvres d'artistes hollandais et de livres d'auteurs néerlandais ou imprimés dans les Pays-Bas, provenant de collections nationales. » G. S.

Opuscula selecta Neerlandicorum de arte medica. Fasciculus sextus quem curatores miscellaneorum quae vocantur Nederlandsch Tijdschrift voor Geneeskunde collegerunt et ediderunt. xv + 352 p. Amsterdam 1927. ISIS

The fifth volume of this admirable publication was analyzed in *Isis*, 10, 304. The present volume contains treatises or addresses by FRANCISCUS DE LE BOË (SYLVIVS), JAN SWAMMERDAM, REGNER DE GRAAF and SCHROEDER VAN DER KOLK. Each work is printed in Dutch and in Latin (or English). Brief analyses will be found in this bibliography in the following sections: XVII(2) C, XVII(2) D, XIX(1) D. G. S.

Ribbius, P. Medici en medische toestanden te Arnhem door alle tijden. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 532-557, 1927. ISIS

Sembianti, Pietro. Appunti di storia medica trentina e dell' Alto Adige. Atti del III Congresso Nazionale d. Soc. Ital. di storia delle scienze mediche e naturali (Venezia, 1925), Siena, 157-162, 1926. ISIS

Sigerist, H. E. Die Geschichte der Medizin im Rahmen der Universitas litterarum. Sonderabdruck aus *Praemedicus*, 10 p. Leipzig, 1927. ISIS

Sigerist, Henry E. Die historische Entwicklung des Entzündungs-

begriffes. Leyden-Vorlesung im Berliner Verein für Innere Medizin und Kinderheilkunde, gehalten am 7. VI, 1926. Reprinted from *Deutsche Medizinische Wochenschrift*, Nr. 9, 10 p., 1927. ISIS

Simon, S. William. The influence of the three MONROS on the practice of medicine and surgery. *Annals of Medical History*, 9, 244-266, 1927. ISIS

Stern, Bernhard Joseph. Social factors in medical progress. (*Studies in History, Economics, and Public Law*, edited by the Faculty of Political Science of Columbia University, no. 287). 137 p. New York, Columbia University Press, 1927. ISIS

Reviewed by F. H. GARRISON, *American Historical Review*, 33, 90-91, 1927.

Sudhoff, Karl. Civilization and health. A historical colloquy. *Medical Life*, 34, 159-164, 1927. ISIS

Veth, Cornelis. De arts in de caricatuur. Met een inleiding van Prof G. VAN RIJNBERK. Amsterdam, Munster's Uitgevers-Maatschappij. ISIS

Reviewed by J. G. DE LINT, *Bijdragen tot de geschiedenis der geneseskunde*, 7, 410-411, 1927.

Wehrli, G. A. Die Bader, Barbieri und Wandärzte im alten Zürich. *Mitt. der Antiquarischen Gesellschaft in Zürich*, Bd. 30, Heft 3, 91 Neu-jahrsblatt. 100 p., 4 pl., 44 text fig. Zürich, 1927. ISIS

Reviewed by K. SUDHOFF, *Mitt. zur Geschichte der Medizin*, 26, 200-201, 1927.

The Wellcome historical medical Museum, 120 p., 16 pl., fig. The Wellcome Foundation Ltd., London, 1927. ISIS

Le Wellcome historical medical Museum (54 a, Wigmore str., London). fondé par HENRY S. WELLCOME, inauguré le 24 juin 1913 (*Isis*, 1, 572; v. aussi 2, 304), et qui avait été fermé pendant près d'un an pour une réorganisation complète nécessitée par l'accroissement des collections, a rouvert ses portes le 14 octobre 1926 (H. S. WELLCOME, directeur; L. W. G. MALCOLM, conservateur) comme organisation permanente. Aux documents d'anatomie, physiologie, chimie, pathologie, pharmacologie, orthopédie, obstétrique, psychiatrie, dentisterie, aux pièces de la statuaire, aux portraits, se sont ajoutés de nombreux souvenirs de LISTER, de JENNER, une section de la guerre; sa bibliothèque renferme actuellement plus de 100.000 livres, manuscrits et incunables. — le catalogue luxueux, richement illustré, qui présente ces collections renferme les discours prononcés en 1913 et en 1926.

A l'occasion du centenaire de la naissance de LISTER (5 avril 1827) est organisée une exposition spéciale d'objets présentant un intérêt scientifique, medical, ou simplement un intérêt personnel, touchant la vie et l'œuvre de

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LISTER, et les périodes pré-listérienne et post-listérienne. Un très beau catalogue, avec nombreuses planches et portraits, a été édité à cette occasion sous le titre « Lister centenary Exhibition at the Wellcome historical medical Museum », 218 pp. Le catalogue proprement dit est précédé d'une étude de Sir HECTOR C. CAMERON : A short account on the evolution of LISTER's system of antiseptic surgery », une étude sur la vie, les recherches expérimentales, et l'influence de LISTER. On a aussi joint au catalogue la bibliographie des travaux de LISTER, et celle des principales notices qui lui ont été consacrées.

L. G.

51. — EPIDEMIOLOGY, HISTORY of SPECIAL DISEASES
PUBLIC HEALTH and SOCIAL MEDICINE.

Andel, M. A. van. De scheurbuik als nederlandsche volksziekte. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 519-531, 1927. ISIS
Scorbut, a disease common in Holland.

Bishop, Louis Faugeres; Neilson, John, Jr. History of cardiology. Introduction by VICTOR ROBINSON. New York, *Medical Life Press*, 1927. ISIS

Kockel, Heinz. Lupus in fabula. *Archiv für Geschichte der Medizin*, 19, 349-350, 1927. ISIS

Menetrier, P. La fréquence réelle du cancer à Paris il y a cent ans était la même qu'aujourd'hui. *Bul. acad. de médecine*, 177-182, 23 févr. 1926. ISIS

Cette opinion de MENETRIER est appuyée sur les renseignements fournis par GASPARD LAURENT BAYLE (1774, o8, 18 — 1816, o5, 11) dans son *Traité des maladies cancéreuses*, ouvrage posthume dont la 1^{re} partie parut en 1833, la seconde en 1839, et qui passa inaperçu. L. G.

Meyerhof, Max. Neues zur Geschichte des Begriffes Pannus. *Archiv für Geschichte der Medizin*, 19, 240-252, 1927. ISIS

« Mein Schluss geht also dahin, dass die Griechen bereits den Hornhaut-pannus bzw. die Keratitis pannosa unter dem Namen κερσοφθαλμία (variköse Augenentzündung) gekannt haben, und ebenso die Umschneidung der Pannusgefässe, vermutlich unter dem Namen ἀγγειολογία, den HIRSCHBERG bei PAULOS nachgewiesen hat. Den Arabern hat ein ganz entsprechendes Wort für die variköse Augenentzündung gefehlt, und sie haben daher das Wort sabal (Müneinflüssen in Gefässe bis zu strotzender Füllung) eingesetzt, während sie für die Operation das gut entsprechende Wort laqt (Zusammenlesen, Aufsammeln der Gefässe) angewandt haben. »

Newsholme, Sir Arthur. Evolution of preventive medicine. xv + 226 p., 7 pl. Baltimore, WILLIAMS & WILKINS, 1927. ISIS

Oudemans, A. C. Iets over de geschiedenis omtrent scabies en de acarus siro. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 369-375, 1927. ISIS

Sigerist, Henry E. Sebastian-Apollo. *Archiv für Geschichte der Medizin*, 19, 301-317, 2 Textabb., 7 Taf., 1927. ISIS

« Die beiden grossen Pestpandemien, die die Geschichte kennt, umrahmen das Mittelalter. Sie sind ihm Anfang und Ende. Aus der grossen Not des 6. Jahrhunderts ist SEBASTIAN erstanden. Unter seinen Schutz hat sich die christliche Welt begeben und er hat sie beschützt, hat sie vor der Seuche bewahrt während vielen Jahrhunderten, ihr die Ruhe gegeben, ihre Sendung zu erfüllen.

Als im 14. Jahrhundert das Mittelalter zu Ende ging, die Welt wiederum dem schwarzen Tod verfiel, SEBASTIAN'S Macht versagte, trat ein neuer Pestheiliger auf den Plan : ROCHUS.

Zu ihnen beiden, ROCHUS und SEBASTIAN, wandte sich das Volk in Zeiten der Not. Gemeinsam wurden sie vielerorts verehrt. Doch wie ungleich das Paar : ROCHUS, der biedere Wanderer, den schweren Mantel umgehängt, den Pilgerstab in der Hand, auf seine Pestbeule deutend. Und neben ihm SEBASTIAN, die Glieder frei, strahlend in jugendlicher Schönheit : APOLLON. »

Sommerlad, Georg. Geschichte der Hämophilie. *Diss.* aus der Leipziger chirurg. Klinik. 55 S. Leipzig, 1927. ISIS

Temkin, Oswei. Zur Geschichte von « Moral und Syphilis ». *Archiv für Geschichte der Medizin*, 19, 331-348, 1927. ISIS

Weyde, A. J. van der. Bijdrage tot de geschiedenis der pest te Utrecht. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 384-404, 1927. ISIS

52. — HISTORY of HOSPITALS and MEDICAL TEACHING.

Hellings, G. Gasthuistoestanden in den « Goeden ouden tijd ». *Bijdragen tot de geschiedenis der geneeskunde*, 7, 501-512, 1927. ISIS

Napius, J. W. De geneeskundige faculteit van de hoogeschool en rijksatheneum te Franeker, 1585-1843. *Bijdragen tot de geschiedenis der geneeskunde*, 7, 577-601, 1927. ISIS

53. — PHARMACY, PHARMACOLOGY, TOXICOLOGY.

Bouvet, M. La thérapeutique d'autrefois : l'aigle, le moineau, l'oie, les œufs. *Paris Médical*, 16^e année, 129-133, 162-167, 1926. ISIS

Chacune des parties des oiseaux : cerveaux, fiel, fiente, graisse, langue, pattes, plumes, coquilles, membrane coquillière, blanc et jaune d'œuf, est étudiée au point de vue de ses propriétés thérapeutiques prouvées ou non,

depuis l'antiquité jusqu'au XIX^e siècle. L'auteur s'appuie pour cette étude rapide sur une bibliographie abondante et précieuse (plus de cent notes).

L. L.

Netolitzky, Fritz. Vom Asphalt über die Mumie zum Ichthyol.
Pharmazeutische Zentralhalle 68, Nr. 4, 1927. ISIS

VIII. EDUCATION.

(the methods of accumulating, imparting and diffusing knowledge.)

57. — MUSEOLOGY.

(*Museums and Collections*).

Kenyon, Sir Frederic George. Museums and national life : the Romanes Lecture delivered in the Sheldonian Theatre, 17 June 1927.
32 p. Oxford, Clarendon Press, 1927. ISIS

Pessler, Wilhelm. Das Heimat-Museum im deutschen Sprachgebiet als Spiegel deutscher Kultur. Veröffentlichung des Werkbundes für Deutsche Volkstums- und Rassenforschung. 158 p., 94 illustrations. München, J. F. LEHMANN, 1927. ISIS

Reviewed by OTTO LAUFER in *Deutsche Literaturzeitung*, 971-972, 1927.

59. — ERRATA and ADDENDA no. 15.

(For previous errata see *Isis*, 10, 311).

ISIS.

Vol. VII, 302. last note. MORI, ATTILIO (not Morri).

567. IORGA, NICOLAE (not Nicolas).

Vol. VIII, 215. GRAFTON ELLIOT SMITH (not G. G.).

741. Second BIRKENMAJER note, l. 2, 307 (instead of 30).

Vol. IX, 138. CLARK WISSLER (without comma).

376, line 12 from bottom. art (instead of representation)
of nature.

SARTON'S INTRODUCTION.

Vol. I, (a) 57, line 20. PAUL MAZON (not Maron).

97, line 5. except (not expecting).

(a) From HOMER to OMAR KHAYYAM. XII + 840 p. (Baltimore, WILLIAMS and WILKINS; London, BAILLIÈRE, TINDALL and COX, 1927.)

346. Christian monasticism, line 6. For the Essenes, see article by KAUFMANN KOHLER in *Jewish Encyclopedia* (vol. 5, 224-232, 1903).
- 418, line 18. Code (instead of Constitution).
- 680, footnote c. On the Khazars, see article Chazar by HERMAN ROSENTHAL in *Jewish Encyclopedia*, (vol. 4, 1-7, 1903).

The following corrections have been kindly suggested by Prof. DR. E. O. VON LIPPMANN (Many others are included in the present Critical Bibliography).

208. HERON : die « Schriften » stammen aus ganz verschiedenen Jahrhunderten, wo sich die Differenzen genügend erklären lassen (HOPPE).
213. CRATEVAS : das « Manuscript of DIOSCORIDES » ist auch jetzt noch in Wien. (I labored under the impression that it was one of the MSS. which Austria had been obliged to return to Italy by the Treaty of Peace).
460. Islam : eine gewaltsame Ausbreitung aus religiösen Gründen ist ganz unbewiesen.
- 745, 774. Chanson de Roland ist doch nicht z. B. dem Nibelungenlied überlegen.

A few other misprints are not mentioned in these errata because they are too obvious to cause any error or confusion. I wish to express my thankfulness to the readers who take the trouble to make the above-mentioned corrections in their copies of *Isis* and the *Introduction*. I would advise them, after having accomplished that little task, to write their initials near mine at the bottom of this note, thus to indicate that these and the previous errata have been taken into account.

G.S.

These and previous errata have been corrected by.....

The corrections have been made in the card index by

Author's Index to the Twenty Third Bibliography.

The Roman figures refer to centuries; the Arabic figures, to the sections of Parts II and III, which are numbered consecutively from 1 to 59. This index will enable one to find more easily the papers analyzed in the present bibliography, and also to see at glance what each writer is doing.

December 10, 1927.

DOROTHY WATERMAN.

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ISIS

**International Review devoted to the History
:: of Science and Civilization ::
Quarterly Organ of the History of Science Society**

FOUNDED AND EDITED BY
GEORGE SARTON, D. Sc.
Associate of the Carnegie Institution of Washington
(Harvard Library, 185, Cambridge, 38. Mass., U. S.)

VOLUME XII

1929

THE SAINT CATHERINE PRESS LTD
35, rue du Tram, BRUGES (BELGIUM)

Printed in Belgium

ISIS

International Review devoted to the History of Science
and Civilization

Quarterly Organ of the History of Science Society.

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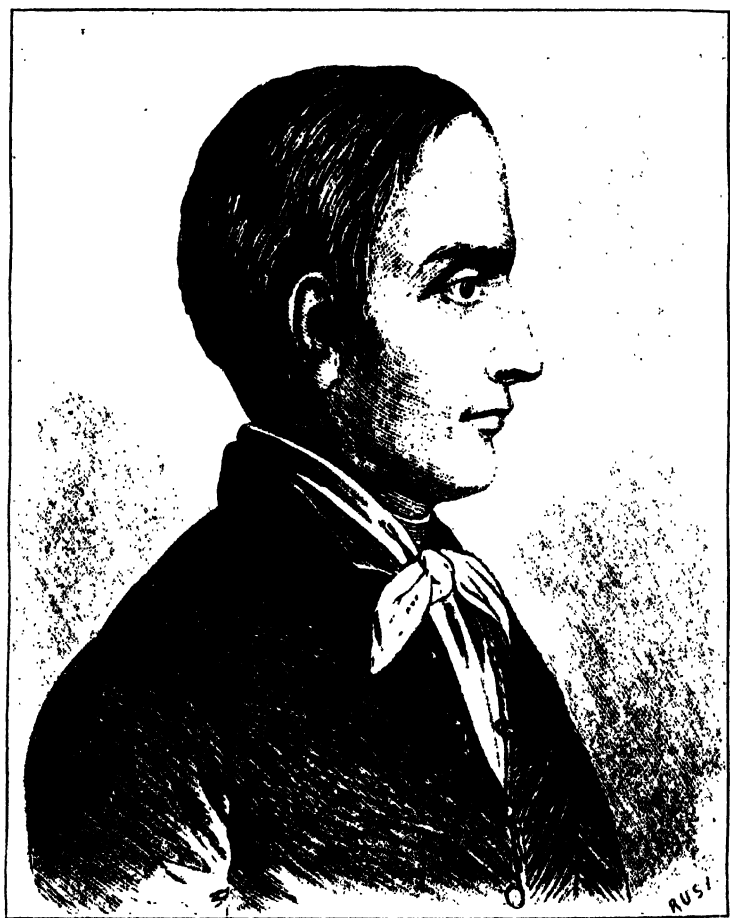
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ALEXANDER CSOMA DE KÖRÖS.

Preface to Volume Twelve.

In 1823-24 the great Hungarian scholar KÖRÖSI CSOMA SÁNDOR was established at the monastery of Zangla (a), in the Himalayas. The weather was extremely severe, and for three or four months, he, the Lama who was instructing him, and an attendant were circumscribed in an apartment nine feet square. « They durst not stir out, the ground being covered with snow, and the temperature below the zero of the scale. There he sat, enveloped in a sheepskin cloak, with his arms folded, and in this situation he read from morning till evening without fire, or light after dusk, the ground to sleep upon, and the bare walls of the building for protection against the rigours of the climate. The cold was so intense as to make it a task of severity to extricate the hands from their fleecy resort to turn over the pages. Some idea may be formed of the climate of Zanskar from the fact, that on the day of the summer solstice, a fall of snow covered the ground; and so early as the 10th September following, when the crops were yet uncut, the soil was again sheeted in snow. » (b).

This is a fine example of scholarly heroism. To understand it we must leave ALEXANDER CSOMA for a moment in his cell with his Tibetan pandit, and look backwards. He was born at Körös, Transylvania, in 1784; was educated at the college of Nagy Enyed and took a few courses at the University of Göttingen. He was a born student of languages, and early in life his dreams took him to the East. Perhaps it would be possible to find somewhere in Central Asia the key explaining the mysterious origin of his people? Perhaps some Asiatic language would help him to understand the extraordinary peculiarities of his own? The affinities between the Magyar and Finnic languages had been

(a) Or Yangla; in Zanskar, Kashmir.

(b) THEODORE DUKA : *Life and works of ALEXANDER CSOMA* (London, 1885, p. 83). To see CSOMA's work in its perspective refer to my *Introduction to the History of Science*, (vol. 1, 466-69, 1927).

observed long before his time, — COMENIUS had already noticed them about the middle of the seventeenth century, — but such facts stimulated the curiosity of philologists instead of satisfying it. From where did both languages come? Perhaps some people might still be found in the Transcaspian steppes or in the mountainous recesses of Central Asia, who spoke some other Ural-Altaic language? This was undoubtedly the powerful magnet which drew this poor Hungarian lad out of his country on an eastward journey. CSOMA did not find the keys he was looking for but in India an English friend gave him a copy of Father GIORGI's (c) old Tibetan grammar, and thus the romantic dream of his youth was gradually replaced by a more tangible and definite purpose. He resolved to master the Tibetan language and to read and summarize their sacred writings. The accomplishment of this purpose led him cheerfully to accept sufferings such as would have discouraged every scholar but the most heroic. In 1823-24, then again in 1825-26, finally in 1827-30, he studied under the most distressing conditions at the feet of Lamas who knew no language but their own and so equipped himself admirably for his great task. His chief and almost only meal was tea served in the Tartar fashion, that is, a kind of soup containing not only tea but plenty of salted butter. His total expenses during fourteen years (1820 to 1834) amounted to four thousand rupees, being a little more than 20 rupees a month for food, travelling, clothes, and wages of servants and pandits, while in Tibet. Another illustration of his frugality is given by the fact that at the time of his death his effects « consisted of four boxes of books and papers, the suit of blue clothes which he always wore, and in which he died, a few sheets, and one cooking-pot. » (d).

CSOMA's grammar and dictionary were published by the Indian Government in 1834, (e) and he wrote a few papers and left

(c) ANTONIO AGOSTINO GIORGI, of San Mauro in Romagna, Augustinian (1711-97): *Alphabetum Tibetanum missionum apostolicarum commodo editum* (2 parts, Rome 1762; one part at least had already appeared in 1759.)

(d) DUKA, p. 123, 152.

(e) *Essay toward a Dictionary Tibetan and English*. Prepared with the assistance of BANDER SANGS-RGYAS PHUN-TSHOGS. XXII + 351 p. *A Grammar of the Tibetan language in English*. Prepared under the patronage of the Government and the auspices of the Asiatic Society of Bengal. 2 parts. Both books published by the Baptist Mission Press, Calcutta, 1834.

behind the MSS. of a few others. However his main task remained unfulfilled, being cut short by his untimely death, at Darjeeling (Sikkim, Bengal) on April 11, 1842. He might have published more, if his reticence had not been equal to his devotion. It is quite clear that his original motive, the discovery of the Asiatic home of the Magyars, had been gradually thwarted by his growing knowledge. One who knew him well (HENRY TORRENS) gave the following testimony : « He (CSOMA), on more than one occasion entered on the subject with me at great length, detailing in particular the Sanskrit origin of existing names of places and hill-ranges in Hungary. My constant request at the close of these conversations used to be that he would record these speculations. He invariably refused, alluding darkly to the possibility of his one day having it in his power to publish to the world something sounder than speculation. In proportion as I pressed him on the subject, he became more reserved with me on these particular questions. He seemed to have an antipathy to his opinions being published. I remember his giving me one day a quantity of curious speculation on the derivation of geographical names in Central Asia. Some months afterwards I had occasion to annotate on a theory of the nomenclature of the Oxus, and, writing to him, recapitulated his opinion on the subject, and begged to be allowed to publish it. His answer was that 'he did not remember'. His exceeding diffidence on the subjects on which he might have dictated to the learned world of Europe and Asia was the most surprising trait in him. He was very deeply read in general literature independently of his Tibetan lore, but never did such acquirements centre on one who made such modest use of them. (f) »

'This proves CSOMA's integrity, without which his heroism would have been vain. Our loss due to the fact that only a small part of his knowledge has become available to others is compensated by our vivid remembrance of his virtues. It is not true to say that his Tibetan grammar and dictionary are « his best and real monument » (g); his best monument is the memory of his life. His grammar and dictionary are bound to be superseded,

(f) DUKA, p. 153.

(g) Epitaph on his tombstone at Darjeeling. See DUKA, p. 154, for text and photograph.

but his achievement will never lose anything of its value; though most people will never be aware of it, its greatness will be perpetuated by a few faithful friends. CSOMA did not have many friends while he was living, he was too deeply absorbed in his work, too much the slave of his own great purpose, but he is sure to have a few friends throughout the ages, as long as our civilization exists.

The distinctive feature of the scholarly kind of heroism, as illustrated by CSOMA's life, is its lastingness. It is not the heroism of a day or a year, but of a life-time. The scholar's task is so great (in fact, it is endless) that there would be little point in showing considerable devotion for a few months, or for a few years, and then forgetting it, — as the military hero does when the war is over. For the scholar as for the scientist, the war is never over, the emergency continues, and as long as his health permits, his zeal as well as his task tend to increase. Death alone can relieve him of his duty. This may seem hard but it has its compensations, and even as the reward of love is love, the main reward of devotion, is the fact of being devoted.

A scholar is apt to feel discouraged at times, especially when for some reason or other his activity is temporarily suspended. He may feel or imagine that his effort is misunderstood or underestimated, or worse still he may think that after all he has not followed the best path, or has not done his full duty. Or again he may suffer because of the unnecessary difficulties caused by poverty and the lack of assistance. I have derived much comfort in such moments of doubt and rebellion from the evocation of this noble man, SÁNDOR CSOMA. I see him sitting in his little room in a lost hamlet of the Himalayas, suffering every kind of physical hardship, and serenely continuing his task. How futile our little discomforts and grievances are compared with those, and how ungrateful and weak we must be, if we complain when he did not.

Contrast this silent life, this quiet continuity of effort away from the world, with our academic pusillanimity. Why bother about what deans think or do not think or about the childish decisions of academies? Do we not know that every thing which is really great has been accomplished by isolated scholars, more often in the face of academies, than with their help? The main

thing is to do one's task and to keep at it; to be faithful to it and to self. Once in a while a real scholar is born, and as soon as he is grown up, he says to himself : « I will do this. No matter if nobody understands or appreciates my effort. I will do this, and keep doing it, and devote my whole life to it. This will be my life. I may be wrong, but if I am not, sooner or later my effort will be understood. For the present, the essential is not to be understood, but to continue my work. » That is as clear as crystal. It is not necessary to go high up in the frozen mountains, as CSOMA did, to lift one's self above the meanness of life and its vicissitudes. Each of us, if he wills, can find his own Himalaya to retreat into and discover peace, the innermost peace that no man can shatter.

Cambridge, Mass.

GEORGE SARTON.

July 14, 1928.

Csoma's portrait. The portrait illustrating this Preface is taken from DUKA's biography above mentioned, a book which has long been out of print. Apparently this is the only known portrait of him. Regarding this portrait DUKA quotes (on p. 166) the following appreciation of it by the Rev. Dr. MALAN. « I thank you for giving me the pleasure of seeing CSOMA's likeness. It reminds me very well of him, although it is younger than when I saw him; he was then weather-beaten, and looked older than this picture. » I wrote to the Library of Budapest to enquire whether there was any other portrait, but received no answer.

Practical Chemistry in the Twelfth Century Rasis de aluminibus et salibus.

TRANSLATED BY GERARD OF CREMONA.

This work, the first known to Western Europe dealing with the preparation of chemical substances for use in subsequent operations, must rank as one of the classics of chemistry and pharmacy. It purports to be, and no doubt is in substance, the work of one of the most celebrated of Eastern physicians, MUHAMMAD IBN ZAKARYA ABU BAKR AL-RAZI, who died A. D. 923, many of whose medical writings were published in the infancy of printing. He was the first to describe small pox, and he invented the seton. It was rendered into Latin in the twelfth century by the eminent translator GERARD OF CREMONA, who died in 1187 A. D., from a text altered and interpolated by Moorish alchemists. It was much read and quoted in the thirteenth century under its own name and under that of 'De spiritibus et corporibus', and was one of the principal sources of the chemistry of VINCENT OF BEAUVAIS's great encyclopedia. During the fourteenth century it was superseded by the « De inventione perfectionis » attributed to GEBER and was gradually forgotten. BERTHELOT (1) gives some account of it from a Paris MS. rather under-rating its importance. The present edition is founded on this and on a late but very good manuscript in the British Museum. Two other manuscripts are at Oxford.

BERTHELOT AND THE « DE ALUMINIBUS ».

BERTHELOT in the above-mentioned work makes three references to the « De aluminibus ». On p. 72 he says that the Paris manuscript (6514) of it ends with the words « Explicit liber fratris ROBERT

(1) *Histoire des Sciences*, 1, pp. 317-9, Paris.

BACHONIS ». The explanation of this is that BERTHELOT, not being a paleographer, did not notice that four leaves are missing from the manuscript, containing the end of the « De aluminibus » and the beginning of the « Breve breviarium » of ROGER BACON -- a treatise dealing with somewhat similar subjects, but based, as far as theory is concerned, very largely on the « De Anima » of AVICENNA, as BERTHELOT remarks.

On p. 287, when discussing the sources of the chemical part of the « Speculum Naturale » of VINCENT OF BEAUVAIS, he says « VINCENT DE BEAUVAIS reproduit, au contraire, un grand nombre de passages d'un ouvrage latin attribué à RASÈS, sous le titre *De Salibus et Aluminibus*. Mais, chose singulière, ces citations, à l'exception d'une seule, ne se retrouvent pas dans l'ouvrage de même titre, contenu dans le Ms. 6514 de la Bibliothèque nationale, ni dans aucun de ceux que j'ai parcourus. Les doctrines mêmes du dernier écrit, aussi bien que celles de l'ouvrage cité par VINCENT DE BEAUVAIS, sont assurément bien plus modernes que l'époque de la vie du véritable RASÈS arabe; j'examinerai plus loin ce problème. » To this we need only add that all the quotations made by VINCENT OF BEAUVAIS, not only in his « Speculum Naturale » but also in his « Speculum Doctrinale », can be verified in our text, as will be seen further on, and that at least six of them could have been found in the text BERTHELOT consulted.

On p. 317-19 BERTHELOT remarks of our treatise : « C'est un écrit essentiellement pratique et où se trouvent des recettes traitant fréquemment les mêmes sujets que celles des opuscules précédents. Il débute en décrivant les différentes espèces d'*atramenta* (vitriols) savoir : l'alcocotar, l'asurin ou alsurin, le calcadis, le calcantum... « Le meilleur est chez nous, en Espagne, et vient de Elebla. GÉBER, dans son livre *De mutatorum* a dit : 'On le traite avec l'aigle'... 'Il renferme des soufres subtils que l'on fait monter et que l'on teint, et qui teignent peut-être' ». Le texte du manuscrit est plus étendu; mais VINCENT DE BEAUVAIS a reproduit les phrases que j'ai citées, et qui renferment précisément l'une des citations qu'il fait de GÉBER..... Mais l'article relatif aux vitriols est le seul que j'aie pu identifier avec une citation de VINCENT DE BEAUVAIS ».

VINCENT OF BEAUVAIS AND THE « DE ALUMINIBUS ».

The edition of the encyclopedic work of VINCENT here used is

that of Douai. 1624. This must be stated as the numeration of the books varies in different editions. The quotations in the *Speculum Naturale* are as follows, the first number being that of the section of our text.

1. l. vii. c. 75; 3. l. v. c. 93; 5.9. l. v. c. 86; 9. l. vii. c. 72; 11. l. vii. c. 70; 17. l. vii. c. 68; 19. l. vii. c. 62; 28. l. vii. c. 6; 32. l. vii. c. 13; 41. l. vii. c. 18; 49. l. vii. c. 54; 58. l. vii. c. 26; 65. l. vii. c. 38; 68. l. vii. c. 42.

The quotations in the *Speculum Doctrinale* are very similar. They are :

1.3. l. xi. c. 122; 5.11.17. l. xi. c. 118; 19. l. xi. c. 119; 27. l. xi. c. 105; 28. l. xi. c. 127; 29. l. xi. c. 128; 32. l. xi. c. 111; 41. l. xi. c. 112; 49. l. xi. c. 114; 58. l. xi. c. 113; 65. l. xi. c. 115; 68. l. xi. c. 116; 00 l. xi. c. 121.

These quotations are valuable as showing the condition of the text of our treatise towards the middle of the thirteenth century; and some use has been made of them here.

ROGER BACON AND THE « DE ALUMINIBUS ».

BACON quotes this treatise in his *Opus Minus* occasionally as « De spiritibus et corporibus », expressly saying, in a passage of the recently discovered part, that this is another name for the « De aluminibus ». The reference by name to the « De aluminibus et salibus » is on p. 381 (ed. BREWER) taken from c. 34; the references to the « De spiritibus et corporibus » are found on pp. 376, 377, 379, 380, 381, 382. They are not easily verified, and seem to show that BACON used a very much enlarged text.

The 'De aluminibus' is not quoted from by BARTHOLOMEUS ANGLICUS in his contemporary *De proprietatibus rerum*.

THE CONTENTS OF THE TRACT.

The title of the work seems to be due to the Latin translator, and is not found in the list of the works of RASIS published by G. S. A. RANKING. (2) It has, evidently, been much altered by its Moorish editors before translation, as shown by the references to places in Spain, and by the mention of the Commentator.

(2) *Proc. XVIIth Inter. Congress of Medicine* (1913), Section of the History of Medicine pp. 246-268. Oxford 1914.

(cap. 5). The true title may be that preserved in the colophon of our manuscript 'Secretum Philosophic Secretissimum', and it may be connected with the *Kitab Alasrar* which Prof. RUSKA is editing. The work deals with four classes of substances used in chemistry; alums or vitriols, salts of all kinds, 'spirits' or volatile agents, including mercury, arsenic, sulphur, and sal ammoniac, and lastly 'corpora', bodies, the metals — gold, silver, iron, lead, tin, and copper. Another class of substances — stones — is not considered.

The treatment of vitriols, after a description (cap. 1) is by dessication and solution in rain water, the sediment of oxides etc. being filtered off (cap. 2). Alums are described (cap. 3). The treatment is by powdering, solution in decomposing urine, with subsequent boiling, the residue being allowed to settle (cap. 4). Salts are heated to dessication, dissolved in rain water and re-crystallized (cap. 6). Native alkali, known as yellow alum, dissolved and re-crystallized (cap. 8). Crude borax is dissolved in whey (weak lactic acid), allowed to decompose, and is mixed with a solution of rock salt in honey water and crystallized (cap. 9). Sal ammoniac is purified by repeated sublimation from a mixture with common salt (cap. 10). White arsenic is prepared by sublimation. It is then dissolved, dried, heated with alkali, melted and solidified (cap. 12, 13). Yellow arsenic is treated with vinegar (cap. 14). Another treatment (cap. 15). A whey treatment of arsenic (cap. 16). A preparation of sulphur (cap. 18). The properties of mercury — the dialogue of mercury and gold (cap. 19). The preparation of mercuric chloride by sublimation from salt, ferric oxide and mercury (cap. 20); from mercury, sal ammoniac and salt (cap. 21). The preparation of mercuric sulphide from an oil solution of sulphur and mercury (cap. 22); from the fumes of sulphur (cap. 23). Preparation of lead-mercury amalgams (cap. 24, 25). Preparation of amalgams generally (cap. 26). Theory of the formation in nature of gold and silver from mercury and sulphur in a thousand years (cap. 27). The four stages of chemical change, calcination, ceration, solution, and coagulation. The object of calcination is the removal of the impure sulphur (cap. 28). Ceration makes the oxide into an easily fusible mass (cap. 29). Solution is the fusion of the mass by gentle long-continued heat (cap. 30). Coagulation is the solidification of the resultant product

(cap. 31). The remaining chapters treat of the various metals in turn, giving their properties and the methods of forming various gold or silver alloys or metals resembling them.

A vocabulary, explaining the numerous Arabic names of substances and apparatus in this tract, is largely taken from IBN BEITHAR's 'Traité des Simples' translated by LECLERC. *Notices et Extraits. vol. XXV.* The text is taken from the Paris Ms. B. N. fonds latin : 6514. (P) as far as it goes, supplemented by the British Museum Ms. Arundel 164. (A). Readings from VINCENT OF BEAUVAIS are marked V.

I. INCIPIT LIBER RASIS DE ALUMINIBUS ET SALIBUS QUE IN HAC ARTE SUNT NECESSARIA.

(S)cias quod attramenta sunt genera multa, et ejus minere invente sunt et ipsum quidem est aqua et tinctura quam terre sicitas coagulavit. Et est in sua natura calidum et sicum. Et ex ejus quidem generibus sunt Alcolcotar et Alsurin et Calcadis et Calcantum; et melius eorum apud nos in Yspania est quod asportatur de Elebla. Et ipsum est quod denigrat corpora, et augmentat rubeum rubedine, et denigrat album. Et eorum subtilius est Alcolcotar, et eorum grosius est Alsurin. Dixit GEBER filius AVEN in libro (3) *Denudatorium* : « Scias quod atramentum est unum ex angulis artificialibus nobilis quantitatis, et regimen ipsius est cum aquila, quoniam atramentum est longinque submersionis, set ipsa submergit ipsum », Et inquit : « in atramentis sunt sulphura subtilia, que sublevantur et colorantur, et forsitan tingunt. » Tibi ergo inest, quoniam est de eo forsitan ambiguitas, non enim, voluerit super experientia nisi promptualitas. Et ex proprietatibus quidem ejus est quia retinet omne fugitivum a fuga. Nota ergo illud esse maximum secretum quod Deus revelavit suis rationalibus creaturis.

2. MODUS VITRIOLI IN OPERATIONE.

Modus autem utendi ipso est, ut sumas de eo quantum vis, et pone ipsum in vase, et fac ipsum manere in furno panis per noctem unam. Exhibet enim rubeum vehementis rubedinis. Sub-

merge ergo ipsum cum (4) quadruplo sui de aqua dulci, et ipsum dimitte donec solvatur in ipsa aqua, et residueat fex ejus in fundo vasis. Cola ergo ipsum, et repone ad horam necessitatis operationis.

3. MODUS ALUMINIS.

Alumen est oleum quod coagulavit siccitas terre et ejus minere sunt multe. Dixit filius GIGIL CORDUBENSIS quod ei erat minera a septent[r]ione Cordube, in loco qui dicitur Neerim, ex circuitu Cordube veteris. Et est in natura sui calidum et humidum; et dicitur calx et sicum; et ipsum quidem est retinens omne volatile, et mundificat corpora mundificatione bona et decorat ea, et augmentat tincturam eorum. Verumptamen denigrat album donec non vegetur de colore nature ejus, et non resolvitur; et rubificat album donec tingat ipsum rubedine bona et naturali, et non resolvitur in eternum; et est compar unius, et tertium duorum, et quartum quatuor. Et dicunt quidem quod alumen est nobilius lapidum, quoniam est frigidum propter suam acetositatem; et est magis configuratum rerum ad regimen arsenici et sulphuris; et convenientius ei.

4. MODUS ALUMINIS JAMENI.

Modus utendi eo est, ut accipias de alumine Jameni albo lanoso puro, et teras optime, et p[ro]hicias in ollam vitreatam; et effundas super ipsum quadruplum sui de urina puerorum. Post decoctionem eorum et ipsarum antiquatione ergo, bulli cam super ignem levem cum alumine, et move ipsum cum ligno motione bona, et dimitte ipsum donec resedeat fex ejus in fundo. Cola ergo ipsum cum facilitate, et repone // f. 125 a. 2. P // ipsam ad multa secreta tua.

5. DE SPECIEBUS SALIUM.

Scias quod sales multi sunt; set nobilius ipsorum est a loco Andarani; deinde sal panis, et sal Indus qui est rubeus, et sal Nabasti, et sal Calcis, deinde sal amarus. Et iste sal amarus est in Yspania in loco qui dicitur Bellengi. Cujus quidem natura est calida et sica. Et est aqua quam congelavit siccitas (5) nature

(4) duplo V.

(5) natura terre] ignis A. V.

terre. Et ex proprietatibus ejus est quod liquefacit argentum cum vehementia ignis, et addit in ipso albedine, et convertit ipsum a corporeitate ad spirtualitatem. Et similiter facit de auro et augmentat ipsum rubidine, et abluit corpora ex sorde, et corrodit sorditiem eorum. Et cum eo calcinantur corpora et non cum alio; et propter hoc nominaverunt ipsum sapientes « argentum communitalis » propter albedinem suam, et quoniam omnes (vel homines) indigent ipso, et utuntur in omnibus rebus, et cum eo rectificatur creatura. Et Deus excelsus non laudavit creaturam in lege sicut est laus ejus in sale. Cum ergo cogitaveris in ipso scies bonitatem ejus. Et sal quidem invenitur in cineribus plantarum, et calcibus lapidis, et ossibus animalium; et in omnibus rebus invenitur sal. Ergo secretum magnum est in sale. Qui ergo scit salem et sicut solutionem et ejus salis coagulationem, tunc jam elevatus est super secretum magnum, quod est sapor sapientum. Et ipse dealbat corpora et (6) mundificat, et resolvit ea; et coagulat spiritus et retinet ea, et prohibet ab eis adustionem ignis. Pone ergo mentem (7) tuam in sale, et prepara ipsum, et non cogites nisi in ipso. An non vides eos omnes aput complementum redire ad salem armoniacum, et dicere ipsum multotiens, et ipsi non volunt nisi salem post preparationem ejus. Provenit enim ex eo sal armoniacus nobilius cunctis, non fugiens ignem. Et HERMES quidem dixit filio suo : O fili, quando sciveris saporem sapientum persequeris concupiscentiam tuam, et evades cum parte meliore. Et ipse quidem est difficilis super istum qui ipsum ignorat; paucum scit super illum qui scit illum, Inquit Compillator, « non poteris querens hanc proprietatem, nisi ignorantia ejus quod occultaverunt sapientes, et de quo evacuaverunt omnes libros, et non explanaverunt ipsum. Et ego quidem juro per Deum, si non quo non est Deus, qui est sciens, et absens et presens, vir qui ignorat secretum salis non comprehendit parum vel multum ex eo quod conceditur ei comedere, quoniam cum ignorat secretum ejus est sicut ille qui vult sagitare cum archu sine corda. ».

6. MODUS OPERATIONIS IN SALE ALCHIMIE.

Modus autem utendi ipso est ut accipias de eo partem unam,

(6) mundificata P.

(7) suam P.

et tere ipsum optime ultime; et ponas ipsum in ollam, et opiles ipsam opillatione bona, et pone ipsum in furno panis nocte aut die. Deinde solve ipsum in duplo sui de aqua dulci, deinde et deinde coagula ipsum, et invenitur sicut nix. Repone ergo ipsum, et non utaris eo nisi soluto, et si non, non proficies eo.

7. MODUS SALIS ALKALI.

Scias quod sal alcali est melius salium, et melioris essencie et magis conveniens quam ista commistioni salis masse. Ipsum enim coagulat, et propter illud nominaverunt ipsum auctores lapidem fixum faciens : et non est factum nobilius salium in virtute, nisi quia est plantalis; plante namque sunt due virtutes, scilicet, virtus mineralis et virtus plante. Salis virtus animalis superfluit ei virtute tertia cum virtute minere et virtute plante, cum sint aggregate in ipso ad virtutem ipsius. Atende ergo proprietatem salis alkali cum lapide fluminis albo, et qualiter colat ipsum, et facit ipsum redire in vitrum, et non est ex salibus hujusmodi proprietatis. Et per vitam meam ego (8) expertus sum salem alkali super ignem, et vidi ipsam velocius liquefieri quam sales omnes multas, quoniam in sale alkali est unctuositas alba non adusta. Excusamur ergo per hunc salem ab alio, cujus quidem natura est caliditas et humiditas, quoniam est oleum quod coagulavit ignis sicitas. Et dicitur quod natura ejus est calida et sicca, et est fixus in igne, convertens, junctens omne volatile ex mineralibus, sicut argentum vivum, /125.b.1.P./ sulphur, et arsenicum; et coagulat ea, et retinet ea in igne, et resolvit corpora omnia. Excusare ergo per eum ab aliis, sicut excusatur vitrecarius per ipsum ab aliis, quoniam cum ipso calcinat lapidem album fluminis, et cum ipso solvit ipsum et liquefacit eum, et facit eum redire in vitrum. Similiter ergo absque dubio, est ejus operatio in corporibus et spiritibus et in metallis ergo super ipsum. In ipso enim occultatur scientia ejus quod preparaverunt primi. Sunt ergo ex eo secreta in[nu]merabilia et operationes nobiles. Jam ergo per Deum detexi tibi secretum occultatum.

8. MODUS SALIS ALKALI IN OPERE NOSTRO.

Modus quidem utendi eo est, ut sumas de alumine Alasphor

(8) expertus sum] jam spiritus sive P.

partem, et tere eam bene, et pone ipsam in vasse vitreato, et proicias super libram unam de eo sex libras aque dulcis, et (9) coque ipsum super ignem donec consumatur de aqua sexta pars, et mitte ipsam donec resideat fex ejus in fundo, et elevetur aqua. Sume ergo colaturam ejus, et prohice fecem; deinde pone ipsa in vas eris aut vitreatum, et coquas ipsum super ignem, cum facilitate super ignem paulatim, donec coagulatur sicut christallinus sal nobilis, et repone ipsum et letare cum eo.

9. MODUS PLURIUM SALIUM IN OPERE NOSTRO. MODUS LIQUEFACIENDI CORPORA EX LAPIDES.

Pars atincaris ipsius, accipe de eo partem, et solve ipsum in duplo sui de aqua casei postquam antiquatur aliquod diebus. Et accipe de sale panis equale sibi, et solve ipsum in duplo sui de aqua dulci, in qua jam dissolute sunt due de melle apum; deinde agrega illas duas aquas; decoque illud super ignem lentum donec coaguletur simile saphyro, et repone ipsum, et occulta ipsum. Et est ex utilitatibus nobilibus. Cum ergo volueris liquefacere corpus aut lapidem, tunc si fuerit corpus, sume ipsum preparatum aut calcinatum aut lavatum; et si fuerit lapis, tunc tritum pulverizatum; tere ergo ipsum ultime et pone ipsum in buticatim vitreatum argillatum, et super et suffla super in igne, donec liquefiat sicut adeps. Oculta ergo hunc salem nobilem, est enim mirabilis; et laude Deum super illud quod dedit tibi: sal enim iste coagulat ydroargirem, et cum eo eriguntur corpora coagulata, et cum eo tenetur omne fugitivum et volatile, et cum eo cerantur corpora et spiritus. Et iste quidem est sal illud quod occulte tetigerunt philosophi et sapientes, et occultaverunt ipsum; et est sal armoniacus eorum, et acetus ipsorum, et eorum sal. et tincar ipsorum; scias ergo illud.

Scias quod sal armoniacus est melior salium, et ipsorum nobilior in regimine; solvit enim ydroargiron et facit ipsum redire ad hoc ut sit aqua currens quando sublimatur cum eo, et intro-mittitur ad solutionem in loco rorido; et ipse quidem est oleum quod coagulavit sicitas ignis, et natura ejus est calida et sicca subtilis et profundans penetrans, et est spiritus volans adjuvans

ad (10) lachesir; et si ipse non esset, non compleretur hoc sir; neque exsolveretur neque ingrederetur. Et in ipso occultatur secretum et est egrediens, prosilens, incerans omnia corpora, et extrahit nigredinem ex profundo eorum, et resolvit ea; et est lapis qui generat et pererit, et remanet vestigium generationis ejus dum permanet seculum; et in ipso sunt secreta multa quando resolvit ipsum, et resolvit salem panis. Et permiscet utraque, et coagula ea donec parveniant sicut glacies. Cum jam sint commisti liquefacti insimul, et remaneat cum eo, et retineat uniusquisque eorum comparem suum, et figantur in igne et non fumigent quando semper adhimentur. Quando ergo facti sunt res una, tunc ciba ex ea omne corpus quod vis solvere, liquefacit enim ipsum et solvit ipsum, precipue ferrum. Et scias quod omnes cui convenit aliquid in regimine suo, laudat ipsam et extollat super ipsum. Radix quidem salis armoniaci est ex stercorebus et humiditatibus animalium, et generatur in loco ubi incenditur ignis balnearum, etiam in concavitate vasis, et in talibus.

10. PREPARATIO SALIS ARMONIACI.

Modus utendi eo est, ut solvatur in intestino in vase cum aqua aut coletur aut in vitreata. Aut substernantur /125.b.2.P./ ei folia apii, aut folia siele, vel blete; et melius quidem est ut sublimetur tibi si volueris ipsum convertere in duobus plumbis, et ere, et ferro; et si converteris ipsum in auro et argento, tunc sublima ipsum (11) septies; est enim finis ejus et subtilis.

Modus quidem alius est, ut sumes de sale armoniaco partem unam, et tere ipsum cum equali pondere sui de sale, et sublima ipsum in aludel a sale ter aut septies, et renovetur sal ei invice omni, inde invenies enim ipsum simile nivi in scuto aludel.

11. LIBER DE ARSENICO RUBEО ET CITRINO.

Arsenicum quidem anima et est minerale; et caliditas et humiditas est natura illius; et est secundum duos modos, rubeum et citrinum; et illud quod ego expertus sum est citrinum laminosum, cum in utrisque non sit fortius eo, neque quod vehementius eo adhurat corpora. Est arsenicum quidem simile sulphuri in

(10) alakesir V.

(11) sapiens P.

multis operationibus, in (12) subtilitate et velocitate liquefactionis, et parvitate expectationis super ignem. Citrinum vero magis est expectans super ignem quam rubeum; et citrinum est copiosioris tincture et laudabilioris successionis. Et de proprietatibus quidem ejus est quod albificat aliud quando sublimatur, et denigrat quando non sublimatur; et adhuc dum permanet vivum. Quod autem volunt de arsenico est ejus albificatio, et delectio oleagenitatis ejus, et remotio adhustionis et combustionis ipsius. Dixit autem GEBER filius AYEN, in libro *Denudatorum* quod ipsum quando dequoquitur cum oleo de amigdalibus amaris et alio venit ultimum. Et existimavit secta quod acetum retificat ex eo rectificationem; post quam non est corruptio; et quod ipsum scit ipsum in judicio sui complementi et ipsum per vitam in eam, facit apparere de eo mirabilia ex operationibus. Intellige ergo illud et exstima secreta, quoniam est lapis quorundam abjectus, projectus in foris et stercoribus et balneis, quoniam est radix noce; et ipsum quidem ligat ydroargiron in corpore, et complet ipsum quoniam cum eo est frater. Inquit KALIT filius JEZIR, «in argento vivo est secretum, non in alio»; et sunt ei in mineralibus corpora que sunt (13) ei comparativa, si super omnes habes rationem; facit ergo ipsum deficere, et ligat ipsum lapis citrinus extra ipsum. Et in ipsis quidem regimen est secundum tres modos, sublimatio, et ablutio, descensio vel quietatio, donec albificetur.

12. OPERATIO ARSENICI IN OPERE ALCHIMICO.

Modus sublimationis ejus est, ut accipias de eo partem ad libitum tuum, et teras ipsum, et solves ipsum in viscere vel intestino sicut scis. Deinde cola ipsum et inbibe ipsum arsenico trito cum contritione et assatione donec perveniat in ventre ejus. Deinde pone utrumque in teratio vitreato, et suppone ei alutel, et stringe ex conjunctione cum adherentia decenter facta et luto capillorum; et pone illud in loco ubi incenditur ignis, et ascende ignem sub eo decem oris, tribus cum igne levi, et septem cum igne forti. Cum ergo infrigididatur, agrega quod sublimatum est ex eo cum lana. Si vero non patet tibi albedo ejus, tunc itera super ipsum donec pateat tibi; et illud tribus vicibus; et permuta ei salem

(12) sublimatione V.

(13) ei comparativa] composita A.

solutum in omni vice; exhibet enim sicut camphora. Et secretum quod in cognitione comprehensionis sublimatorum est ut pulverizes ex eo super laminam argenti et igniti, et non denigrat ipsum.

13. MODUS ABLUTIONIS EJUS.

Et modus ablutionis ejus est, ut inbibas ipsum sale soluto sicut premissum est; et assa ipsum in furno panis, hora post horam, donec compleatur pondus ejus de sale soluto. Abluc ergo ipsum a sale in vase vitreato, et quotiens egreditur aqua salsa cola ipsam donec egrediatur aqua dulcis, in qua non sit salsedo. Sicca ergo ipsum, et cera ipsum cum sale alkalli soluto quod sit pondus illius, donec videas ipsum sicut adeps. Solve ergo ipsum in igne levi donec solvatur, et coaguletur; repone ergo illud.

14. ALIUS MODUS CUM SALE ET ACETO.

Aliud nobilius ec. Accipe ergo de arsenico citrino bono laminoso partem, et de sale masse equale ei. Solve ergo ipsum in duplo de aceto forti, et inbibe arsenicum cum contritione ex exsiccatione, rei post rem, donec compleas ipsum, et assa ipsum, et abluc ipsum cum aqua dulci donec removeatur ab eo salsedo, (14) donec / videatur album ut nix. Deinde combure cum eo quodcunque corpus volueris. Est enim ultimus.

15. ALIA PREPARATIO ARSENICI.

Sume ex arsenico bono partem, et tere ipsum contritione ultima in mortario eris, et repone ipsum, et accipe de sale tibi, post assationem ejus et remocionem sonitus ipsius; et solve ipsum in aqua, et coagulatio ejus et solucio ejus in duplo sui de aceto forti, et intra cum eo arsenicum cum contritione, et inbibe sole calo, rem post rem, donec compleas ipsum, et albificetur. Confice ergo ipsum cum pondere sui de oleo predicto, et pone totum in vitreata, et luta ipsam, et pone ipsam in furno panis, et proice super ipsam primas cum cinere in nocte, et extrahe eam, et tere illud, et itera illud donec videas ipsum corpus album simile argento.

(14) end of P. f. 169. b. A.

Fac ergo cum eo quod vis, et pervenies cum eo ad voluntatem tuam, cum auxilio dei.

Proice de ipso dr. 1 super 10 eris aut ferri aut duorum plumborum, et consequeris ea per ipsum, et suffla super ea cum igne alkir et carbonum donec liquefiat argentum bonum.

16. ALIA PREPARATIO ARSENICI.

Accipe de arsenico bono partem, et equale ei de sale tibi inter utraque simul contritione ultima, et pone utraque in vase vitreato lutato luto sapientie, et submerge in aqua casei postquam acescit et non cesses ea coquere in igni leni valde, et quociens exsiccatur aqua, inbibe illud aqua alia, et sic calida donec videas illud simile pulci spisse. Cum autem exciccatur ab eo aqua, proice super ipsum ex butiro recenti simile ponderi arsenici. Et coque / f.170. a.A / ipsum cum eo paulatim donec fiat sicut adeps.

Sume ergo de stagno quod sit equale ei et liquefac ipsum, et ciba ipsum cum duplo suo de argento vivo, et tere cibatum de arsenico, et pone totum in ventosa vitreata, et stringe ex capite ejus, et luta luto sapientie, et pone ipsum in naphis, et accende super ipsum carbones, et dimitte per noctem; deinde infrigida ipsum et extrahe ipsum et proice dr. 1 super unciam 1. eris aut ferri, et proveniet tibi argentum, cum auxilio dei et potencia rei.

17. COMPARAT SULPHUR ARSENICO IN NATURA SUA.

Sulphuris natura est sicut natura arsenici, et regimen ejus est sicut regimen ipsius equaliter, secundum quod dicunt auctores artis in libris suis, et ego non sum expertus. Set expertus sum illud, ipsum cum argento vivo, et sublimavi ipsum cum eo, et venit michi uziphur mirabile. Et expertus sum in combustione eris, et evenit michi rosatide mirabile, id est, calx ceca, secundum quod dicam, si deus voluerit. Quod autem de eo (15) volitat est remotio adustionis ejus, et deletio oleaginitatis ejus, et albificatio ipsius, sicut arsenici equaliter. Et de ipso melius est rubeum. Et dixit JEBER filius AIEN in libro *Urad*, quod arsenicum stat statione sulphuris in rubidine, et sulphur stat statione arsenici in albedine. Set non sum expertus.

18. PREPARATIO SULPHURIS.

Sume de ipso partem, et tere ipsum cum pondere sui de alumine Jameni, et proice super ipsum de urina antiquata que cooperiat illud, et coque ipsum cum igne leni, et bulliat in ipsa donec consumatur aqua et placeat tibi color ejus et albedo ejus. Et si non, tunc itera super ipsam aqua casei acetosa calefacta, et itera illud super ipsum donec albificetur, et fac ingredi in opus tuum.

19. DE NATURA MERCURII.

‘Mercurius est ille... etc’. Scias quod ipse est frigidus et humidus, et ex eo creavit deus omnes mineras, nam ipsum est elementum eis, et est acreum, fugiens ab igne. Cum ergo figitur ei aliqua fixio efficit operationem sublimen, et est spiritus(16) utilis, et non est aliud in mundo nisi ipsum nec est aliquid quod stet loco ejus, et est profundum solum in omni corpore erigens ipsum. Cum ergo permiscetur corpori vivificat ipsum et illuminat ipsum, et convertit de dispositione ad dispositionem, et de colore in colorem. Cum enim aggregatur cum eo et commiscetur ei, est ei fermentum. Est ergo totum elixir albedinis et rubedinis, et est aqua permanens, et aqua vite et mortis, et lac virginis in aherba ablutionis, et est fons animalis de quo qui bibit non moritur, et est susceptivum colorum, et medium eorum, et faciens acquirere colores. Et est illud quod mortificat et vivificat, siccatur et humectat, calefacit et frigidat, et facit contraria secundum mensuram regiminis ejus. Et sunt ei quando vivum operationes, et quando est mortuum operationes alia ab aliis, et quando est sublimatum alie operationes, et quando est solutum alie operationes in igne. Et ipse est draco qui maritat seipsum, et impregnat seipsum, et parit ex die suo, et interficit ex veneno suo animalia omnia. Et ignis perdit omnem rem et finit ipsam, et (17) disparat tempore brevi(18) propter argentum vivum, non enim potest super ipsum necquam comedit ipsum, set fugit ab ipso. Ingeniaverunt ei sapientes primi philosophi modos ingeniorum, donec paulatim frigidum est expectans ignem. Non ergo cessat gradari super pugnamentum ignis et cibaretur eo, ita quod quando ei figitur,

(16) in imis solum V.

(17) dispergit V.

(18) nisi V.

aliquantula fixio proveniunt inter utraque mirabilia et mutationes, quoniam cum ipsum mutatur mutat, et perit nigredo ejus et sonitus ejus et splendor ejus. Cum igitur tingitur tinctum est et tingit, quando coagulatur coagulatum est et coagulat, quando solvitur solutum est et solvit. Et ipsum albificat /f.170.b.A/ in visione oculi et rubeficat : in successione et est acetum attrahens et adtrahens acetum, et aqua congregans et lac, urina fortis, et oleum mollificans, et pater (19) mirabilium omnium, et est caligo et nubes, et servus fugitivus; et mercurius accidentale est illud quod pretulit se auro et vicit ipsum. Dicit ergo ei aurum : 'An tu prefers te michi'. 'Et ego sum dominus lapidum (20) exspectans ignem'. Dixit aurum : 'Utique'. 'Set ego genui te, et ex me natus es, et una pars de me vivificat multas partes de te, et tu es avarus et non das aliquid ex te per comparisonem ad me. Et qui ligat me cum fratre meo et sorore mea vivit et gaudet, et sufficit ei in vita sua. Et si viveret mille millibus annis et reficeret omni die septuaginta millia homines, non egeret. Et ego sum secretum totum, et in me occultatur scientia. Quia ego converto omnia corpora in lunam cum arsenico, deinde converto ea in solem cum setariz » Et in ipso quidem sunt quatuor regiminis species, quorum una est sublimatio a sale et atramento, cum sale armoniaco, cum cibatione cum corporibus, coagulatio cum odore plumbi et cum odore sulphuris.

20. SUBLIMATIO MERCURII.

Sublimatio autem ejus sale et atramento est ut accipias de eo quantum volueris, et contere ipsum cum equali sui de atramento et equali sui de sale. Et sit sal solutus in intestino vel viscere. Et tere ipsum cum eis, et sicca donec moriatur in eis. Deinde pone ipsum in aluthel absque humiditate postquam assaveris in furno panis in nocte. Cum ergo fuerit mane extrahes ipsum, et inbibas ex sale soluto, et reduces ad furnum, et fac de eo multotiens dum nigretur corpus. Quotiescumque facis morari in furno coloratur ad rubedine. Tunc ergo pone ipsum in aluthel et stringe ex conjunctione, et mitte ignem sub eo, et ut jam posuisti ipsum super furnum in forma actanor, et accende sub eo tribus horis in diebus

(19) mineralium V.

(20) execrans V.

estatis, et in diebus hiemis usque ad noctem. Dimitte ergo ipsum donec infrigidetur et aperi aluthel, et invenies in superiori ejus jam sublimatum album clarum, auxilio dei et potencia rei.

21. ALIA SUBLIMATIO MERCURII.

Sublimatio ejus cum sale amoniaco est ut accipias de servo fugitivo duas partes et fac ipsum cum medietate sui de sale amoniaco albo conquassato et equale salis amoniaci de alio sale, et non cessa ea terere in unum donec moriatur in eis. Deinde pone ipsum in aluthel secundum predictum modum. Sublimatur enim album, simile alumini lanoso. Et est ex nobilioribus operibus sublimibus. Repone ipsum.

22. COAGULATIO MERCURII CUM SULPHURE.

Coagulatio ejus cum sulphure est ut accipias 3 oz. de oleo sisamino si est possibile, et si non de oleo olivarum. Bulli ergo ipsum super ignem in vase vitreato et proice in ipsum postquam bullitum est oleum mediam unciam sulphuris citrini, et teratur paulatim donec liquefiat in ipso sulphur. Deinde remove ab igne, et dimitte ipsum quiescere in ipso. Deinde proice in ipsum unciam unam de servo fugitivo et reduc ad ignem vas, et accende sub eo paulatim, ipsum enim coagulat lapis rectus rubeus. Repone ergo ipsum et intromitte in opere, et gaudebis cum ipso.

23. ALIA COAGULATIO MERCURII CUM ODORE SULPHURIS.

Et modus alius est, et illud est coagulatio ejus cum odore sulphuris, quod est ut ponas ipsum in panno spisso, et liga ipsum, et suspende in vase, et pone in fundo vasis sulphur et stringe ex conjunctione, et accende ignem sub eo die integro, et demitte ipsum donec infrigidetur, et depone ipsum ab igne. Invenies enim rubeum salem uzifur. Intromitta ergo ipsum in opere rubeдинis, et gaudebis cum eo, quia in eo sunt mirabilia multa que non /f.171.a.A/ numerantur. Si vis solvere ipsum solve cum sale amoniaco. Et si vis argentum vivum coagulatum, tere ipsum coagulatum. Et si vis albificatum, tere ipsum cum aliquanto de sale alkali et cerusa. Assidua ergo super ipsum contritionem et inhibitionem. Albificatur enim et est sicut sublimatum. Et si vis ut remaneat ejus tinctura rubea fixa, tere ipsum cum aqua

atramenti aut zafrani de ferro et aqua salis amoniaci. Rubificatur enim et figatur ejus rubedo. Scias hoc.

24. ALIA COAGULATIO MERCURII CUM ODORE PLUMBI.

Modus autem coagulandi ipsum cum odore plumbi est ut fabrices ei speram ceream et lutes eam cum luto sapientie. Cum ergo siccatur lutum, perfora ipsum et evacua ceram, et proice in ipsum argentum vivum, et claude foramen et proice ipsum in vas in quo liquefactum sit plumbum, et accende sub ipso ignem duabus horis. Coagulatur in lapis albus. Reponc ipsum ad opus tuum ergo.

25. ALIA COAGULATIO MERCURII IN CANNA GROSSA.

Et est modus alius, et illud est ut accipias cammitum de canna grossa, et luta ipsum luto discretionis. Deinde proice in ipsum argentum vivum donec impleas ipsum. Postea cooperi luto sapientie, et fac ei foveam secundum mensuram ipsius, et pone sub eo frustrum plumbi, et pone cammitum super ipsum, et liquefac plumbum, et funde in foveam in circuitu cammiti donec submergatam cammitum in plumbo. Dimmitte ergo ipsum donec infrigidetur. Deinde luta super plumbum cum luto sapientie et sicca ipsum. Deinde accende ignem super ipsum donec liquefacit plumbum in luto, et congelet odor ejus mercurium. Dimitte ergo infrigidari et extrahe ipsum. Invenies enim congelatum ex meliori re. Et hoc est melius quod ego expertus sum in congelatione argenti vivi. Occulte ergo ipsum in nomine Christi.

26. CIBATIO MERCURII CUM CORPORIBUS.

Modus cibandi ipsum cum corporibus est ut liquefacias quodcunque eorum vis, excepto ferro, ipsum enim non cibatur eo, et proice super corpus quod liquefesci duplum ejus de argento vivo, et lava cibatum ex aceto et sale donec egrediatur nigredo ejus. Deinde exsicca in sole, et tere ipsum cum eo quod vis, cum aquis eris acutis, super ignem subtilem aut in solē. Fac itaque illud die integro. Deinde solve ipsum cum solvitur cum ipso arsenicum albificatum. Deinde intromitte totum ad solvendum. Cum ergo solvitur, coagula. Tingit enim uncia ejus quadringentas uncias eris, et erigit ducentis unciis duorum plumborum, auxilio

dei et ejus virtute. Et scias quod resolutio est thesaurus rei, et in ea est omne secretum. Solve ergo quomodo vis, autem cum igne stercoris, vel in loco rorido, seu in balneo aquoso. Tu enim solves cum eo omnes calces et limaturas, auxilio dei. Et dixit JEBER : ' Scias quod sublimatio est spiritibus, sicut solutio corporibus', Et dicam modum solutionis post hoc.

7. TRANSMUTATIO ARGENTI VIVI ET SULPHURIS IN AURUM ET ARGENTUM ARTIFICIALITER.

Scias quod corpora mineralia sunt vapores qui inspiasantur et coagulantur secundum mensuram servitutis nature in spatio longe. Et primum quidem quod coagulatur est mercurius et sulphur. Et sunt duo elementa minere. Et [non] sunt aqua et oleum, set unum generatur ab aqua et aliud ab oleo super quibus assiduatur decoctio equaliter cum caliditate et humiditate donec congelata sunt. Et ex eis generantur corpora, et permutantur gradatim donec fiant argentum et aurum in millibus annorum. Et si remanerent ista corpora in mineris suis, prepararet ea natura, donec pervenirent ad argentum et aurum. Possint ergo deus excelsus de sapientia sua in hoc mundo sublimi minori, qui est compar mundo majori, ut consequantur ista cum argento et auro in die uno, subtilitate dei et ipsius misericordia. Et nominant ista sulphura terre.

28. CALCINATIO MERCURII ET SULPHURIS.

Regimen autem eorum est secundum quatuor modos, calcinatio cum sale, ceratio et solutio, deinde coagulatio. Calcinatio earum est combustio /f.171.b.A/ eorum cum igne vehementi et sale, ut deleantur ab eis sulphura corrumpentia et remaneant munda sicut calcas, et est algir. Inquit JEBER : ' Non est necesse calcinare ea, nisi propter quietem partium eorum et preparationem ipsorum, ut perveniat humiditas ad profundum eorum et sit possibile ea solve, ut fiat fortis eorum siccitas'. Quare susceptibilia humiditatis, et velociora ad fundendum, in alia diminutione, sicut aurum et argentum. Et non est necessarium calcinare duo plumba et es et ferrum nisi propter causam precedentem, et ut fugentur sulphura eorum corrumpentia, et pereat unctuositas eorum comburens. Illud vero quod est brevius est extractio humiditatis

corrumpentis, et intromissio humiditatis ignee rectificantis per quam est vita ipsorum et eorum essencia. Fac ergo ipsam.

29. CERATIO ARGENTI VIVI ET SULPHURIS.

Ceratio vero eorum est sublimatio partium ejus cerati ut minoretur et subtilietur, et ut profundetur humiditas in corpore; quia necessarium est in arte complementi. Et non fit ceratio nisi cum contritione et inibitione donec veniat sicut cera. Et est kir, que liquescit super ignem cum minore caliditate. Intellige ergo illud et cerationem quidem totam invenerunt novi.

30. SOLUTIO EORUM.

Solutio autem eorum est ut accipias ea calcinata cerata, et pone in vitreatam, et stringe caput ejus, et fac foveam et pone in ea paleam, et mitte in ipsa vitreatam, et cooperi cum palea, et proice super eam stercus equi, et rora cum aliquantula aqua, et dimitte eam septem diebus. Hec est ergo solutio caliditatis, et solutio roritatis ut facias foveam et ponas in eam euzam, et mittas in fundo ejus aliquid de aqua, et suspendas vitreatam super ipsam, et non consequatur aquam, et cooperi eam cooperatura bona, et accipe juncturam, et pone super os vitreate ceram, et pone super eam harenam, et dimitte sic die et nocte. Solvetur enim auxilio dei.

31. COAGULATIO EORUM.

Coagulatio autem eorum est ut sumas vitreatam in qua fuit medicina soluta, et ponas in vas, et proicias cribellatum in circuitu ejus ut non inclinetur vitreata, et incende ignem levem sub vase, aliquid post aliquid decem horis, donec egrediatur humorositas, et siccetur humiditas, et coaguletur medicinam sicut uzifur si est rubea. Si autem est alba, invenies ipsam sicut camphoram. Videte ergo ea et gaude cum ea.

32. CAPITULUM DE SOLE.

Scias quod sol est dominus planetarum corporum et lapidum. Et est nobilior eorum quoniam est rex eorum et ipsorum capud. Quod non corrumpit terra nec aqua nec aer nec ignis, necque

minuetur igne, immo (21) rectificat ipsum ignis et humectat. Et non comburunt eum sulphura corpora conburentia, quoniam natura ipsius et ejus complexio est recta, equalis, et clara. In qua complete sunt nature quatuor et equate sunt in eo, ita quod in ipso non est additio nec diminutio. Et in ipso sunt decem partes caliditatis, decem frigiditatis, decem siccitatis, decem humiditatis. Quapropter (22) exulterunt ipsum sapientes et magnificaverunt ipsum, et posuerunt cum eo (23) compositionem exir magni, quoniam est substantia equalis, remanens, permanens fixa, secundum longitudinem eternitatis. Et est ex (24) complexione solis et componitur de eo, quia est calidum et humidum. Et aurum quidem in corporibus est sicut sol in stellis, quoniam sol est rex stellarum, et lumen earum. Per eum conplentur res terre ex plantis et fructibus et mineris, et per ipsum crescit et additur essetia eorum. Et similiter est aurum in corporibus; aurum enim retinet omne corpus et retinetur ab eo. Et est fermentum duorum exir rubei et albi, que non rectificantur nisi per ipsum et non conplentur per aliud /f.172.a.A/ sicut pasta que non conpletur nisi per fermentum. Et similiter quando vis albificare corpora et sublimare ea et extraeris quod in eis est de sorditie et turbiditate, et vis agregare inter ea et conjungere aut commiscere simul, tunc pone fermentum ex eo et tere utraque simul, et confice utraque simul cum aqua duorum exir donec fermentetur, et fiat sicut pasta fermentata. Si autem dixeris quomodo fit fermentum ex corpore, tunc considera. Nam si fermentum non est nisi pasta, tunc similiter hoc fermentum non est nisi corpus. Hoc est et deus, clavis est omnium seraturarum philosophorum et omnium sapientum. Et dixerunt quod fermentum est illud : albificas medicinam, et aufert adustionem, et explanat tincturam, et lenit corpora, auxilio Jhesu Christi. Quod si male consideraveris in eo, corrumpetur opus. Similitudo ejus est similitudo paste et fermenti, et sicut coagula in lacte et sicut muscus in bono odore. Scias ergo illud.

33. ADUSTIO CORPORUM AURI.

Et hoc arsenicum quod contrahit corpora et adustio hec est

(21) reficit V.

(22) extulerunt V.

(23) comparisonem V.

(24) sectione V.

tinctura ejus que tingit corpus per illud quod admiscetur ei ex igne suo. Cum ergo vis adurere aliquid ex eis, tunc cum isto arsenico et ejus commixtionibus adure ipsum.

34. ADUSTIO CORPORUM.

Sume arsenici partem unam, et tere ipsum cum aceto in quo dissolutum est sal per ebdomadum; deinde exsicca ipsum, tere et combure cum eo omne corpus. Comburetur enim.

35. OPERATIO EJUS AD CONVERTENDUM JOVEM.

Liquefac ipsum in crucibulo et proice super decem partes ejus partem unam Saturni et tere ipsum, tritum, enim, tere ipsum cum arsenico liquefacto ponderis sui, et pone ipsum in parvam ollam vitreatam, et cooperi ipsum et decenter apta juncturam, et suffla super ipsum tribus horis cum igne alkir aut carbonum, aut fac ipsum morari in forno vitrearum aut figuli in nocte. Et extrahe ipsum, et cera ipsum cum argento vivo sublimato et cum sale amoniaco soluto cum aqua azezi, aliud post aliud, donec compleatur pondus ejus, et proice de ipso 1 dr. super 1 oz. Jovis et exhibit tibi sol bonus, auxilio Christi.

36. PULVERISATIO AURI.

Accipe aquam dulcem et proice in ipsam litargirum tritum, et bulli ipsum ebullitionibus. Deinde si vis, igni laminas auri, et submerge eas in illa aqua, et si vis liquefac ipsum in illud multotiens donec comminuat. Pone ergo in opere tuo et gaude cum eo.

37. CALCINATIO AURI.

Accipe limaturam auri et permisce cum eo arsenicum, et pone ipsum in panno spisso, et luta illud luto sapientie, et assa ipsum cum igne. Deinde extrahe, et tere ipsum cum aqua et sale, et pone cum eo pondus sui de sale trito, et pone ipsum in cuzam lutatam, quam mittas in furno. Fiet enim calx alba, ut pulvis qui apparet in medio solis.

38. PULVERISATIO AURI.

Accipe de auro bono ayfferam quantum vis, et mallea ipsum

subtilius, et igni ipsum, et extingue ipsum in aquam et sale in qua solutum sit plumbum multotiens, donec denigrata sit aqua et sale. Deinde extrahe eas et tere nam ipse terentur donec fiant ut pulvis in radio solis, ergo utere eo et reserva.

39. ALIA PULVERISATIO AURI.

Accipe de merdascenz et tere ipsum et confice cum oleo, et line cum eo fundum crucibilli. Deinde accipe limaturam auro, et expande in fundo crucibili. Deinde liquefac ipsum. Cum ergo liquefit et infrigidatur tere ipsum, nam ipsum teretur. Repone ergo ad horam necessitatis.

40. AQUA AURI TRANSMUTANS ARGENTUM.

Sume de eo post calcinationem ejus partem, et tere ipsum cum pondere sui cum sale amoniaco solutio donec compleas pondus ejus, et pone ipsum in vitreatam, et submerge in aceto forti, et dimitte in loco rorido quinque diebus. Solvetur enim aqua rubea /f.172.b.A/ sicut sanguis. Cera ergo cum ea mercurium quem sublimasti inprimis ab atramento et sale, et non cesses iterare super ipsum cum contritione et assatione donec compleas ipsum. Intromitte ergo ad solutionem, et cum solvitur, congela ipsum, et proice 1 dr. ejus super decem argenti, et exhibit tibi aurum bonum.

41. CAPITULUM DE LUNA. NATURA ARGENTI.

Scias quod luna est corpus mundum magis diminutum quam aurum. Et est ex sectione lune. Et sicut lumen lune est infra lumen solis, et decor ejus minor decore solis, et sicut non est ei complementum in lumine suo et in virtute sua, similiter est argentum apud aurum. Quoniam argentum corrumpitur in terra et in igne, et sapor ejus ad acetositatem declivus est, et secuntur ipsum nocumenta, et comburunt ipsum sulphura, et minuitur in igne. Set non est post aurum corpus honorabilius eo, et est propinquius corporum ad aurum, quoniam occultum auri est manifestum argenti, et manifestum auri est occultum argenti. Et natura ejus est frigida et humida, et dicitur frigida et sicca, et miscetur cum auro et ere, et suscipit tincturam. Et nos qui jam cum eo fecimus duo exir, album et rubeum, et posuimus

ipsum aurum. Set nocumenta ad ipsum velocia sunt, quoniam ipsum est mundum subtile, et non est ei exspectatio super illud quod ledit ipsum. Et sulphura quidem et stagnum et plumbum sunt ei inimica ledencia ipsum et non conveniunt ei. Et sulphur singulare sit in regimine argenti et eris et plumbi, et arsenicum arsenico et ferro et stagne. Scias ergo illud.

42. ELIXIR ALBUM.

Et argentum quod est corpus exir albi in opere majore, et stat loco ejus stagnum in opere minore, et arsenicum et anima ejus, argentum vivum et spiritus illius, et sal armoniacus et serviens uterque, componens inter utrumque.

43. CONTRITIO ARGENTI.

Liquefac ipsum in crucibulo, et proice super ipsum pondus ipsius stagni. Deinde funde, et tere ipsum quia teretur, et repone ad horam necessitatis.

44. CALCINATIO ARGENTI.

Plumbum stagni liquefac, et funde ipsum in aqua et sale aliquotiens. Deinde igni argentum et funde ipsum in illam aquam, postquam posueris in omnem libram aque illius 1 dr. sulphuris aut arsenici. Nam ipsum calcinatur nigrum. Cura ergo ipsum cum sale soluto, et assa in furno. Deinde ablue ipsum a sale, nam post ipsum albificatur et preparatur. Reconde ipsum.

45. CALCINATIO ALIA.

Si coxeris sulphur in aqua et sale. Deinde inbibatur ei limatura argenti, et intromitte eum in furno in nocte. Deinde abluc a sale, fiet enim calx tribus vicibus alba.

46. CALCINATIO ALIA.

Accipe de limatura quantum vis, et line eam cum oleo. Deinde pone eam in testam super carbones. Cum vero perveniret ad eam flamma, proice super eam aliquid sulphuris donec aduratur, et fiat tuus. Tere ergo ipse cum sale sol[ut]o secundum quod precessit, et veniet tibi pulvis albus, si deus vult.

47. MEDICINA EX ARGENTO AD CONVERTENDUM STAGNUM.

Malleando fac laminas de argento subtiliores quam potes, et igni eas, et extingue ipsas in oleo in quo liquefactum sit aliquid sulphuris, et itera illud donec videas ipsum nigrum. Tere ipsum cum sale sol[ut]um secundum quod precessit, et repone. Deinde accipe de pulvere ejus partem, et equale ejus de arsenico. Tera ergo ipsum cum alumine solutato in urina cum equali sibi de sale amoniaco cum contritione et inhibitione donec compleas de ipso, et pone totum in ovo gallino vacuo lutato luto saphientie, et pone super os ejus corticem animalium, et luta enim lute saphientie, et sicca ipsum, et pone ovum /f. 173.a.A/ in igne stercoris vacce, aut in cinere qui non sit vehementer ignitus, et sit in eo die ac nocte. Deinde extrahe ipsum, et invenies coagulatum argentum. Proice ergo de eo 1 dr. super octo stagni, et exhibit tibi luna, si deus voluerit. Et nobilius eo non est aliud.

48. MEDICINA ALIA AD IDEM.

Accipe laminam argenti, et de arsenico preparato ad comburendum corpora quartam partem ejus, et cooperi ipsum cum eo, et pone in ovo galline lutato, et pone ipsum in ollam cum cinere, et pone ollam in furno panis in nocte. Deinde extrahe, et tere ipsum cum aqua aluminis et salis amoniaci donec videas ipsum sicut adipem. Proice ergo super stagnum de eo. Et si acceperis argenti pulverem tritum cum arsenico, tere ipsum utraque, deinde fac utraque ingredi in combustionem. Et est opus tuum nobilius et subtilius. Fac ergo quodcumque eorum vis et proveniet tibi, si deus voluerit.

49. CAPITULUM DE MARTE : NATURA FERRI.

Ferrum est ex divisione Martis, et natura ejus est calida et sicca, et dicitur frigidum et siccum. Et est masculinum et femininum, acetosum in sapore, vehementis virtutis, expectans ignem, impugnans ipsum. Et liquescit cum quatuor rebus, cum arsenico, plumbo, magnesia, et marchasita. Et quando suspenditur cum auro, vel impregnatur, non separatur ab eo semper, nec per examinationem nec per aliud. Cum ergo permiscetur aurum cum argento, tingit argentum tinctura bona, et erigit ipsum in examinatione. Et est ex secretis Indorum, et voluptas eorum. Est ferrum

solum inter reliqua corpora, et propter illud elegerunt ipsum sapientes. Et quoniam est levioris diminutionis, facilioris compositionis, et fixe tincture in opere rubidinis et albedinis. Et regimen est ejus secundum (25) duos modos, liquefactio ejus cum sebie et liquefactio ejus cum sale amoniaco, et nos dicemus illud totum.

50. FUSIO SEU LIQUEFACTIO FERRI.

Jam diximus quod ferrum est durius corporum et fortius ipsorum, et non solvitur in igne penitus nisi per medicinam vehementem. Et illud est ut accipias de laminis ejus factis subtilius, et igni eas, et extingue in oleo in quo liquefactum fuerit plumbum multotiens, donec perforantur et limantur valde. Incide ergo cum forpicibus subtiliter. Deinde accipe de plumbo partem, et liquefac eum cum in cocleari ferreo, et proice ipsum pondus ejus de argento vivo. Deinde tere ipsum donec videas ipsum pulverem. Pone ergo de ipso stratum et de laminibus stratum donec inpleas crucibilum, et pone ipsum in furno, et suffla super ipsum cum igne alkir et carbonum donec liquefiat. Deinde evacua ipsum, et itera super ipsum multotiens donec placeat tibi color ejus, et fiat velox fusio ejus. Tunc ergo utere eo.

51. LIQUEFACTIO ALIA : CONVERTETUR STAGNUM IN LUNAM PERFECTAM.

Accipe de limatura ferri quantum vis, et proice super ipsum de arsenico trito bono equale quarte ejus, et pone ipsum in panno sine accretione alicujus, et luta ipsum luto sapientie. Cum autem exsiccat super ipsum, pone in furno fusionis, suffla super ipsum cum igne alkir tribus horis. Deinde infrigida ipsum et extrahe, et tere ipsum cum pondere sexte ipsius de sale alkali illinito cum oleo, et pone ipsum in botum barbatum, postea igni super ipsum cum alkir et carbonibus donec descendat ad inferius albac, et remaneat scoria ejus superius in crucibulo primo. Deinde extrahe illud quod descendit, reduc ad liquefactionem, et itera liquefactionem ipsum super /f. 173.b.A/ donec fiat, sicut plumbum in liquefactione. Et si vis, accipe nitrum tincar, et tere ipsum utraque cum oleo, et fac de eis formas avellanarum, et ciba illud ex eis, et liquefac illud decem vicibus, additur enim velocitas

liquefactionis, et dealbedo, et si multiplicaveris illud leniter, itaque liquescit in spacio brevi simile liquefactioni plumbi, et molleatur. Liquefac ergo de hoc ferro preparato 1 dr., fac venire super ipsum quinque dr. stagni mundi, donec liquefac cum eo. Exibit enim dura luna recta ad igniendum et malleandum.

52. LIQUEFACTIO ALIA.

Et si vis, accipe limatura plumbi, et funde limaturam cum eo sicut facis cum arsenico. Fit enim velox liquefactio ejus, autem liquefactio ejus autem liquefactione ipsius, et additur albedo et levitas.

53. MEDICINA EX FERRO CONVERTENS STAGNUM IN AURO.

Accipe limaturam ferri, et rora eam cum aceto forti, et pone ipsum in sole, et itera operationem super ipsum cum octava parte, et tere ipsum cum aqua azezi donec videas ipsum rubeum simile croco. Tere ergo ipsum cum octava parte sui de sulphure, et combure ipsum, et tere ipsum cum aqua azezi et salis amoniaci sicut premissum est. Et proice de ipso super quatuor stagni aut argenti duo dr. et exhibit aurum, si deus vult.

54. ALIA LIQUEFACTIO AD IDEM.

Accipe de sale alkali quantum vis, et confice cum eo arsenicum tritum citrinum, et line cum eo laminas ferri, et igni eas, et extingue eas in illo semper donec albificentur, et fiant radiales in colore argenti equaliter, et non sit addicio nec diminucio. Remove ergo ipsum. Ipsum enim est durum, et non est differentia inter ipsum et argentum nisi durities in ipso tantum. Tere ergo ipsum tantum, et aggrega ipsum in crucibulo bono, et proice super ipsum litargiri albificati aut ceruse frustrum, aut frustrum baurac sapientum, aut quod currit cursu illius; ipsum namque solvetur velociter in aqua hujsumodi. Cum ergo solvitur, tere cum ipso es. Tunc si diliges ut fundes ipsum, et iteres super ipsum multotiens, fac donec placeat tibi, et fiat essentia plumbi in liquefactione. Deinde permisce ipsum cum stagno mundo, et permisce utraque cum argento, et fac ex hoc quod vis. Est enim mirabile, cui non est simile, velocis operis et propinqui temporis, veruntamen in eo est aliquid laboris in hora lenificationis ferri tantum.

55. SOLUTIO FERRI CONVERTENS PLUMBUM IN AURO.

Accipe de sulphure citrino partem, et tere ipsum, et pone in testam, et bulli ipsum in duplo sui de oleo donec liquefiat sulphur in ipso. Deinde accipe laminas ferri quatuor partes, et igni eas, et extingue in oleo, et suffla vice unam post aliam donec adurantur lamine et denigrentur, et terantur. Et si vis, accipe laminas, et line eas cum sulphure liquefacto in oleo, et pone eas in olla vitreata, et cooperculo vitreato cooperi, et stringe ex conjunctione luto sapientie, et fac eam manere in furno panis in nocte, et sepeli in cinere calido, mane autem extrahe eas, et tere eas ultime. Deinde accipe de atramento quantum est pondus ferri, et assa ipsum in furno panis hora una, et solve ipsum in duplo sui de urinis antiquis, et cola ipsum in vitreata. Deinde pone pondus sui de sale amoniaco albo, et sine ipsum donec resolvatur in ea. Cera ergo corpus cum hac aqua, aliud post aliud, donec inpleas ipsum. Deinde proice ex ipso 1 dr. super 1 oz. plumbi, et exhibit aurum si deus vult.

56. MEDICINA ALIA CONVERTENS ARGENTUM.

Sume de limatura ferri quantum vis, et pone ipsam in vitreatam, et demerge eam in aceto fortissimo duplo sui, et dimitte in eo quinque diebus aut amplius. Deinde cola acetum ex ea, et accipe quod re- /f.174.a.A/ -manet de limatura, et assa eam in cocleari ferreo, et tere ipsum in mortario, et proice eam in acetum limature donec resolvatur totum aqua rubea sanguis sicut. Deinde accipe de plumbo partem, et liquefac ipsum, et proice super ipsum pondus sui de argento vivo, et tere ipsum ultime, et lava cum aceto et sale donec mundificetur a nigredine. Deinde sicca ipsum, et inbibe ipsum de aqua illa, rem post rem, donec compleas ipsum. Proice ergo 1 dr. super quatuor argenti, tunc pone eas in (26) cuzan examinationis cum ossibus et plumbo donec egrediatur plumbum in litargirum, et remaneat argentum in aurum completum, Christi auxilio.

57. MEDICINA ALIA CONVERTENS STAGNUM IN AURO.

Accipe de atramento bono absque assatione sua in furno,

infunde ipsum in duplo sui de urina antiquata, et dimitte in ea donec dissolvatur. Cola ergo eam decenter et proice fecem, et pone totum in vitreata, et proice in eam pondus atramenti de limatura ferri, et dimitte ipsum quinque diebus donec dissolvatur limatura in ea. Accipe ergo de ere quantum vis, et tere ipsum, et inbibe ipsum de aqua illa, rem post rem, donec compleatur aqua tota. Proice ergo de isto 1 dr. super quatuor stagni, et exhibit aurum, auxilio dei. Et adijunge super ipsum 1 dr. auri puri, et faciet ipsum bonum, et eveniet tibi ultimum, cui non erit simile. Oculta ergo ista capitula, quoniam ex operibus nobilibus.

58. CAPITULUM DE ERE : NATURA ERIS.

Es quidem est ex divisione Veneris, et natura ejus calida et sicca, set siccitas ejus est frigida et sicca. Et es est in virtute argenti, et liquefactione sue et sue duricici, verumtamen est rubeum. Qui ergo cradicat rubedinem ejus facit ipsum redire argentum, et est in manifesto suo es, et in oculo suo argentum. Et est anima et soror argenti, et commiscetur cum auro et argento, et recipit tincturam, et fit de eo exir albedinis et rubedinis, et non fugit tinctura ejus quando solvitur cum aqua atramenti aut cum aqua aluminis. Aqua eris liquefacit omnia corpora et omnem rem ex lapidibus; et regimen ejus est sicut regimen ferri.

59. DEALBATIO ERIS.

Accipe laminas eris quantum vis, et subtilia et submerge eas in oleo in quo solutum aliquid sulphuris aut arsenici, et sit sulphur octonarius ejus, et line eas cum oleo multum, et reponere eas in cuzan, ita ut sternas sub eis salem tritum, et pone ex eis stratam super aliam, sternas sub eis et super eas salem donec compleas eas. Et cooperi super cuzanam et fac eam morari in furno figuli in nocte una. Mane autem extrahe eam, et accipe laminas, et tere eas in mortario brundusii contritione bona. Deinde ablue eas a sale cum aqua dulci donec egrediatur sapor salis, et sicca eas. Hoc ergo erit et est.

60. RUBIFICATIO ERIS.

Si autem vis rubedinem, accipe de atramento assato in furno panis equale ponderi ejus, et submerge ipsum in duplo sui de

aqua antiquata, et dimitte ipsum in ea donec resolvatur. Deinde cola ipsum decenter, et proice super ipsam equale sui de sale amoniaco. Cum ergo solvitur in ea, cera cum ea es ustum, rem post rem, donec compleas eam, et videas ipsum frustrum simile uzifur. Accipe ergo ex eo parte, et ex plumbo quatuor partes, et cooperi ipsum cum eo in crucibulo, et funde ipsum donec submergatur in ipso, et exhibit tibi aurum, vitrute Christi. /f.174.b.A/

61. AUGMENTATIO AURI EX ERE.

Et si vis, accipe de eo partem, et de argento duas partes, et fac ex eis laminas subtiles. Deinde sternere eramine sub isto argento et super ipsum in crucibulo. Deinde funde ipsum fusione bona, et postea infrigidetur. Deinde pondera ipsum, et non addas in pondere argenti aliquid, et est citrinum bonum. Deinde funde ipsum post illud bis vel ter, et funde in urinam pueri antiquatam donec fiat citrinum, et egrediatur facies et ejus fricatio citrina. Pone ergo ex eo partem, et ex auro bono mediam partem, et partem cum parte, et erit bonum.

62. ALIA AUGMENTATIO.

Tolle ex calcecameno partes due, et tere eum contritione ultima in mortario eris cum parte sulphuris, et ipsum pone in ollam vitreatam et cooperi, et pone ipsam in furno panis tribus diebus vel quatuor horis. Et si vis, pone loco calcecameno zunzar bonum et purum, et combure ipsum cum sulphure ut dixi. Deinde tere ipsum cum aqua atramenti et aquile, sicut scis, et proice de ipso dr. duos super duo argenti, et exhibit aurum. Si ergo placet tibi color ejus, et erit bonum; si vero non, liquefac secundo, et super ipsum proice dr. aliam, evacua ipsum, et lauda deum quia hoc fit die uno, cum auxilio Christi et ejus virtute. Quod si vis miscere ipsum cum auro, pone de ipso partem et ex auro bono partem, et liquefac ea ter; nam erit ultimum, si deus vult.

63. AUGMENTATIO ARGENTI EX ERE.

Accipe aliorum bonorum quatuor capita, aut quod vis; et tere in mortario de ligno cum aliquantulo salis et aluminis. Deinde pone in vase, et funde super ea de aceto forti quod submergat ea, et coque illud in caldario eris decoctione bone. Et inveni

descriptione alia, cum aqua saponis, et non sum expertus; verumtamen est melius quod agitur. Deinde accipe laminas eris subtiles, et igni eas, et extinge in illo multotiens donec egrediantur albe. Commisce ergo cum argento quomodo vis, et si vis incide eas cum forcipibus, et pone eas in crucibulo cum aliquanto antincar aut nitro, et cum liquefiant pone super eas alexir albi dr. in x. drachmis, et dr. duo argenti, et evenit tibi album ad fusionem et ignitionem et malleationem, et nunquam solvetur aut auferatur auxilio Jesu Christi.

64. MEDICINA EX ERE CONVERTENS ARGENTUM.

Partem limature eris accipe, et de argento vivo equale sibi. Tere ergo utraque donec uniantur, et alblue ea bene cum sale et aceto donec mundificetur, et ablue cum aqua dulci, et exsicca ea. Deinde accipe de atramento equale eri, et desolve ipsum in duplo sui de urina puerorum antiquata, et cola ipsum. Et proice in ipsam pondus sui de sale amoniaco, et tere ipsum cum hac aqua, rem post rem, donec bibat ipsam totam, et fiat purpureum, jam maritato argento vivo et eri, et ipso et eris. Gauderis cum eo sicut premissum est, et proice de eo super es, et exhibit argentum.

65. CAPITULUM DE JOVE ET NATURA STAGNI.

Stagnum: quod etiam alanoch et alfersen et plumbum alkalay: est ex secutione Jovis, et natura ejus est calida et humida, set est minorata caliditas, quoniam complexio ejus est corrupta per dominium super ipsum. In minera ipsius, et in ipso sunt mollities et stridor et velocitas liquefactionis et acetositas. Qui ergo removet ab eo has quatuor passionnes reducit ipsum ad argentum, cum auxilio dei. Et est gravis tinctura, et fige in ea tincture, et albeficat es propria, quoniam est cum singulare cum eo. Et recipit tincturam rubeam, et fit ex eo sol sublimis, et fit ex eo aqua acuta, et retinetur cum eo argentum vivum, et est (*alia littera*) unicum inimicum argenti [et eri] et conveniens soli et ferro [f.175.a.A/

66. MEDICINA EX STAGNO CONVERTENS ES IN AURUM.

Accipe de eo partem et pone ipsam in capola ferri et liquefac ipsum, et pone super ipsum pondus sui de sale trito, et move ipsum cum ferro donec fiat pulvis. Deinde extrahe ipsum, et tere

attritione bona. Deinde pone ipsum in vase figuli, et stringe caput ejus, et pone super ipsum lutum sapientie, et mitte in furnum panis in nocte. Extrahe ergo ipsum, et tere et bulli ipsum de aqua, et move donec resedeat fex ejus. Deinde proice aquam salsam, et mitte super ipsum claram, et extrahe ipsum, et move motione bono. Deinde dimitte ipsum paululum. Deinde cola ipsum, et fac hoc donec gustes aquam sine salsedine, et non videas in eo nigredinem. Deinde sicca ipsum donec desiccetur et fiat calx. Deinde accipe de alumine jamini equale ei, et tere ipsum, et funde ipsum in duplo sui de aceto forti aut de urina antiquata, et proice super ipsum pondus sui de sale albo amoniaco, et dimitte ipsum in eo donec solvatur. Cera ergo calcem cum hac aqua, rem post rem, et teres ipsam, et inbibes ipsam, et facies ipsam sitire solem. Cum ergo exsiccatur, tere ipsum, et inbibe, gutta et gutta, nec proices ipsam una vice. Fac illud de eo donec ceretur et humectetur, et videas in vicibus x aut xi, jam ultimasse in ceracione, quia retinetur in manica et tabula ex humiditate ejus et ipsius viscositate, et rarificantur partes ejus. Accipe ergo de ere unciam unam, et liquefac ipsum in crucibulo, et proice super ipsum de eo 1 dr. et sufla super ipsum suflatione bona donec liquefiat, et subjungatur medicina in eo, et erit aurum, deo volente.

67. MEDICINA IGNOTA.

Forte acetum sume et solve in eo salem et salem amoniacum; quibus solutis repone ipsum, et accipe quantum vis de stagno, et funde in cocleari de ferro. Cumque liquefit, funde super ipsum de racienti, et est alkitan, et dimitte ipsum donec aduritur. Quo adusto, evacua ipsum in aquam predictam. Fac illud de eo multotiens donec veniat tibi bonum. Et si vis, stilla super ipsum de hac aqua, et stagnum sit liquefactum prius, donec frangatur. Tere ergo ipsum cum ea donec bibat eam. Quodcunque eorum vis, fac, et pervenies cum ea ad artem quam oculaverunt philosophi si intellexeris et deus fortunet te.

68. CAPITULUM DE SATURNO : NATURA PLUMBI.

Alasrob est Saturnus, qui etiam est alalkoth. Et est frigidus et siccus, et est ex secutione Keion et in ipso sunt aurum et argen-

tum per potentiam non per visum. Et ipsum est gravis (27) [corporis velocis liquefactionis] tardi motus, et cum suscipit tincturam non potest separari ab eo in eternum. Et ex eo exit argentum, et ipsum est filia ejus. Et fiunt ex eo litargirum et cerusa et is-rengenz. Et ex eo fit elixir majus rubei et albi, et fiunt ex eo aque arte, et retinetur cum eis argentum vivum, et aque convenientes ferro, et quando miscetur ei non separatur ab eo. Et miscetur cum stagno et non separatur ab eo. Et rectificatur cum cre preparato; et unitur cum argento, set separatur ab eo per examinationem. Et non rectificatur cum auro, recens et ventus ejus frangit aurum. Et ventus ejus coagulat argentum vivum. Et conveniunt philosophi Indi, quia ipsum est propinquius corporum auro quoniam occultum auri est frigidum et siccum, et occultum plumbi /f. 175.b.A/ est calidum et humidum. Firmatum est ergo quod frigidorum siccorum corporum est Saturnus, ergo oculum ejus sine dubio est Sol, quoniam manifestum ejus frigidum est et siccum, et oculum ejus est calidum et humidum. E contrario plumbi alkalay, id est, stagni, quod est in oculo ejus argentum, et in manifesto suo aurum, quoniam invenimus Solem et Lunam in Saturno propinquius super nos quam Jovem, et possibilius, et facilius etiam vendicatione sua, et plus in exuberatione. Inquit PICTAGORAS: 'Scito quod plumbum est magnesia, et quod secretum totum est in eo, et est tenera mulier'. Et inquit quod 'in hac muliere sunt tria: albedo, nigredo, rubedo'. Et in ea sunt quatuor res: humiditas, liquefactionis velocitas, et siccitas, quoniam est ipsa sulphura, et quia ipsa aduritur, et in ea est frigiditas, quoniam extingit caliditatem.

69. DEALBATIO JOVIS ET SATURNI.

Modus de Jove vel Saturno est ut salem sumas tibi in duplo sui de aceto forte, et accipe stagni aut plumbi limaturam, et non cesses ipsum inbibere ex eo, et tere ipsum donec bibit ipsum totum. Fac ergo ipsum morari in furno, sicut premissum est, et exhibit album, si deus vult.

70. CONVERSIO PLUMBI IN AURUM ET ARGENTUM.

Solve zimar in duplo suo de aceta forti, et distilla ipsum, et

(27) from V. tincture A.

tere cum eo calcem Lune, et inbibe cum eo quod vis. Deinde solve ipsum. Deinde coagula ipsum, et proice unum super decem, et tinget ea, cum auxilio dei et ejus virtute. Si vero calx fuerit aurum, erit consilium nostrum completum. Scias ergo stationem ejus cum aqua zegi rubei, aliquotiens est enim ultimum. Ergo occulta ipsum, et age cum eo et prosperabis.

EXPLICIT SECRETUM PHILOSOPHIE SECRETISSIMUM.

* * *

GLOSSARIAL INDEX

- Acetum* Vinegar, or any sort of corrosive liquid. cap. 11, 26, 34, 56, 58, 63, 63, 66, 67, 69, 70. fortem 14, 15, 53.
- Alalkoth* lead : often metallic antimony from lead glance 68.
- Alanoch* (al-anuk. Ar.) tin. 1143IBN BEITHAR. 65.
- Alasphor* (al-aşfar Ar.) yellow 1280IBN BEITHAR 8.
- Alasrob* (al-asrub Ar.) lead. 1042IBN BEITHAR 68.
- Albac* (al-bâqi Ar.) the residue 51.
- Alfirsen* (? firs Pers.) tin 65.
- Algir* (al-jir Ar.) calx or plaster 28.
- Alium* garlic 11.
- Alkir* (al-qîr Ar.) bitumen or asphaltum, mineral pitch 1818IBN BEITHAR 15, 35, 50, 51.
- Alkitan* (al-kiţran Ar.) liquid pitch 67.
- Alsurin* a very impure red oxide of iron; syricum, soricum 1.
- Aludel* (al-'utal Ar.) an open tube to receive the products of sublimation 11, 12, 20, 21.
- Alumen* alum 3, 47, 48, 58, 63.
- Alumen Alasphor* yellow alum, i.e. native soda or kali 1280 IBN BEITHAR 8.
- Alumen Jameni* alumen from Yemen, preferred as the best. 4, 18, 66.
- Alumen lanosum* efflorescent salts of iron and aluminium. 21.
- Amigdalīs amaris, Oleum* Oil of bitter almonds. 11.
- Andarani* (Anderany Ar.) Salt, purest and perfectly crystallized from Andera near Aleppo. 2164IBN BEITHAR. 5.
- Anima* used for *spiritus*, any of the four volatile bodies. 11.
- Apium* parsley or wild celery. 10.
- Aqua acuta* any corrosive solution, either acid or alkaline; whether containing metallic salts (Cu, Sn.) or no. 26, 65.
- Aqua aluminis* solution of alum. 48.

- Aqua antiquata* probably decomposed urine — an impure solution of carbonate of ammonia with phosphates and chlorides. 60.
- Aqua atramenti* solution of vitriol 23.
- Aqua azezi* (zâj Ar. *vitriol*) probably a solution of vitriol 1080IBN BEITHAR 35, 53 *v.* *Aqua zegi*.
- Aqua Eris* *v.* *Aqua acuta* 26, 58.
- Aqua saponis* a solution of soap. A lessive rich in potash made from oak-ashes by lime. 43.
- Aqua zegi* (zâj Ar.) a solution of vitriol 70.
- Aquila* sal ammoniac, so-called from its volatility 1, 62.
- Argentum* silver, luna. 41.
- Argentum*, fusion of 5.
- Argentum communitatis* a synonym of sal amarus 5.
- Argentum vivum* mercury 50.
- Arsenicum* sulphides of Arsenic, red (rubeum) realgar; yellow (citrinum) orpiment, sandarac. 11, 12, 13, 33, 34, 35, 37, 48, 49, 51, 54.
- Athanor*, *actanor* a kind of furnace for slow heatings 20.
- Atincar* (al-tinkar Ar.) a kind of nitrum 9. *v.* *tincar*.
- Atramentum* vitriol of iron or copper. 1, 19, 20, 23, 40, 55, 57, 58, 60, 62, 64.
- Aurum* gold, sol 32.
- Avellana* a nut. 51.
- Ayfferam* a kind of gold (unidentified) 38.
- Baurac sapientum* (baurac Ar.) either carbonate of soda etc, or chrysocolla, or nitrum, or borax. Two colours, white and red. 381IBN BEITHAR 52.
- Bellengi* perhaps Valencia (Balansyya Ar.) 5.
- Bletes* orache, or wild cabbage 10.
- Botum barbatum* (Bucherbut Ar.) a separating apparatus of two crucibles nested — the upper perforated to allow melted material to pass into the lower 51.
- Buticatim vitreatum argillatum* (buṭaga Ar.) a crucible of glazed clay 9.
- Calcadis* (qalqadis Ar.) a white vitriol. 1080IBN BEITHAR 1.
- Calcantum* (qalqant Ar.) a green vitriol. 1080IBN BEITHAR 1.
- Calcecamenum* (culcucesameno) aes ustum, χαλκός κεκαυμένος 62.
- Caldarium eris*, a copper cauldron 63.
- Calx* a synonym for alum 3.
- Calx ceca* perhaps a basic red sulphide of copper 18.
- Cammitum* a section of a hollow reed 25.
- Camphora* camphor 12, 14, 31.
- Canna grossa* a large hollow reed, bamboo 25.

- Capola ferri* an iron cup 66.
Casei, aqua sour whey 16, 18.
Cerusa ceruse, white lead, basic carbonate of lead. 73IBN BEITHAR 23, 68.
Citrinum Arsenicum laminosum mineral orpiment 11.
Coclearis ferreus an iron ladle or spoon. 50, 56, 57.
Colcotar (qalqadar Ar.) the residue of calcination of sulphate of iron, yellow vitriol 1.
Compiler 5
Cooperculum vitreatum a glazed cover 55.
Curduba Cordova 3.
Corpus Arab alchemical name for metallic bodies. 5, 9, 11, 14, 19, 26, 27, 32, 33, 34.
Crucibulum Crucible 39, 43, 51, 54, 60, 61, 63, 66, 50.
Cucurbita cucurbit 37.
Cuza, cuzat (kuzat Ar.) a vessel (*Sp.* alcuza) 30, 37, 56. *cuzan* 59.
Dialogus auri et mercurii 69.
Elebla an unidentified iron mine, but the island of Elba may be meant. (*Ablat* is a fort between the two districts of Granada and Almeria) 1.
Eramine bronze 61.
Es copper, Venus 58, 59.
Exir the elixir 9, 19, 32, 41, 42, 58, 68, 63 *sir* 9, *luchesir* 9.
Fermentum a ferment 19, 32.
Ferrum iron, Mars 9, 49.
Forcipes, forcipes tongs, forceps 50, 63.
Furnum a furnace 37, 44, 45.
Furnum figuli potter's furnace 35, 59.
Furnum fusionis melting furnace 51.
Furnum panis baker's oven 2, 6, 13, 15, 20, 48, 62, 55, 66.
Furnum vitrearum glass-maker's oven 35.
Geber, filius Ayen JABIR IBN HAYAN 1, 11, 17, 26, 28.
Hermes 5.
Ibn Gilgil Cordubensis a Spanish alchemist, quoted by ALBERTUS MAGNUS 3.
Ignis stercoris Heat of fermenting manure 26, 47.
Intestinum (v. Viscus) an intestine; afterwards used for any vessel in which decomposition takes place «In the horse's belly» 10.
Isrengenz (Asronj Ar.) red lead, minium, $Pb_3 O_4$ 74IBN BEITHAR 68.
Jovem v. stagnum
Kalit ibn Jezir KHALID IBN JAÇID IBN MU'AWIJAH (635-704) 11.
Keion Kaiwan, the planet Saturn 68.
Kir (qîr Ar.) bitumen 1818IBN BEITHAR 29.
Lac virginis mercury or mercuric chloride 19.

- Lachesir* the elixir 9.
Lapia fluminis alb. white sand. 7.
Liber Denudatorium also *Mutatorium*. 1, 11.
Liber Urad ? Book of descents or sending down (Irad) 17.
Litargirum litharge Pb O 2114IBN BEITHAR 36, 54, 56, 68. v. murdasen.
Lutum capillorum a lute using hair as binding material 12.
Lutum discretionis a lute 25.
Lutum sapientis 16, 24, 25, 37, 47, 55.
Magnesia probably a manganese ore 49.
Marchasita a variety of pyrites — either gold, silver, copper or iron 2116IBN BEITHAR 49.
Mars iron.
Mel apum honey 9.
Mercurium mercury 19.
Merdasenz (murdâsenj Alr.) white or red litharge Pb O 2114IBN BEITHAR 39. v. litargirum.
Metals named 10, 15, 16, 41, 42, 54.
Mortarium a mortar 56.
Mortarium Brundisii a bronze mortar 59.
Mortarium de ligno a wooden mortar 63.
Mortarium eris a copper mortar 15, 62.
Naphis a vessel 16.
Neerim near Cordova — alum mine 3.
Nitrum impure natural carbonate or sulphate of soda 51, 63.
Oleum olivarium Olive oil 22.
Oleum sisaminum sesamy oil 22.
Olla a flask 6, 48.
Olla vitreata a glass flask 4, 35, 62, 55.
Ovum gallinum a hen's egg 47, 48.
Pannum a cloth 23, 51. *spissum* 37.
Pasta dough 32.
Pictagoras PYTHAGORAS 68.
Plumbum lead. Saturn 49, 50.
Plumbum alkalag (qala'i Ar. of Malacca) tin (Malacca lead) 1042 IBN BEITHAR 63, 68.
Plumbum, odor the exhalations in lead smelting which may contain Chlorine and Arsenic 19, 24.
Plumba, duo lead and tin are called in Arab alchemy the « two leads » 28.
Pulci spisse thick pottage 16.
Racienti synonym for alkitan—pitch 67.
Sal salt, anything resembling common salt. 2164IBN BEITHAR. 5, 63, 69.

- Sal alkali* (qali Ar.) salt prepared from the ashes of saline plants. 1828IBN BEITHAR. 7, 8, 13, 51, 54, 23.
- Sal amarum* bitter salt 5.
- Sal armoniacum, amoniacum* sal ammoniac, often mixed with carbonate of ammonia, sometimes carbonate of soda. 5, 9, 10, 11, 19, 21, 23, 35, 40, 42, 49, 48, 47, 53, 55, 60, 64, 66, 67 v. aquila.
- Sal calcis* any lime salt 5.
- Sal Indus* probably rock salt with impurities to turn it red 5.
- Sal masse* impure rock salt. Massa sometimes means alchemy. 7, 15. v. sal alchemie 6.
- Sal nabasti* unidentified 5.
- Sal panis* common salt as used in baking. 5. 9.
- Sapor acetosa* 4, 49, 59.
- Saturnus* (v. Plumbum).
- Sebic* (zibaq Ar.) mercury. 1143IBN BEITHAR 49.
- Servus fugitivus* a synonym for mercury 2, 22.
- Setariz* unidentified 19.
- Sicla* ? flea-wort 10.
- Sulphur* 1.
- Sulphur nature of* 18.
- Sulphur odor of* 19.
- Sol* (v. aurum).
- Stagnum* stannum, tin. May sometimes be argentiferous lead 51, 65
- Testa* a tile 46, 55.
- Tincar* a kind of nitrum 51, 63. v. atincar.
- Urina* Urine 47.
- Urina antiquata* decomposed urine — a solution of impure ammonium carbonate with phosphates and chlorides 18, 57, 66. v. aqua antiquata.
- Urina pueri antiquata* The urine of boys would be rich in phosphates 61, 64.
- Urina puerorum* 4.
- Uzifur* (zanjifur Ar.) cinnabar, mercuric sulphide. HgS. 1132IBN BEITHAR 17, 23, 31, 60.
- Vas Vitreata* a glass flask, 8, 10, 13, 15, 16, 22, 30, 31, 56, 57, 63.
- Vas Vitreata figuli* an earthen vessel 66.
- Ventosa vitreata* a glass flask 16.
- Viscus* (v. intestinum) 10, 12, 20.
- Vitrearius* a glass worker 7.
- Vitriolum* vitriol 1.
- Zafrani de ferro* (zafr. Ar. dirtiness) An oxide or verdigris of iron 23.
- Zimar* (zanjâr Ar.) verdigris or malachite 73, 70 1131IBN BEITHAR
- Zunzar* 62.

La Peste de 1763 en Dalmatie (*)

II

G. C. P. CICA VO

Nyk.S.88.2^v

Relazione della Peste insorta l'anno 1763 nei
Borghi di Spalato, con il Progetto dell'Autore
per diffendere la Dalmazia dai successivi Attacchi
del Morbo contagioso.

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Jaderae Dalmatiae MDCCI xvii.

**Relazione della Peste insorta l'Anno 1763 nei Borghi
di Spalato con il Progetto dell'Autore per diffendere la
Dalmazia dai successivi Attacchi dal Morbo Contagioso.**

f. 2^r

La Provvidenza che con incessante diffusione di grazie, socorre 3^r
dal Cielo le angustie de' Mortali, rivolse il benigno influxo
della Misericordia Divina verso questa Popolazione, ispirando
la gran Sapienza dell'Ecc.mo Senato, ad eleggere con maturità
di Consiglio la cospicuissima Persona di S. E. il Sig. PIETRO
MICHEL (1) in Prov^r Generale della Dalmazia, ed Albania, onde
coll' efficacia di quelle Virtù luminose, che singolarmente l'ador-
nano, potesse come ha fatto salvare questa Provincia dall'eccidio
crudele, che li due più Severi Flagelli dell'ira di Dio concitata le
minacciavano.

Le Somme attenzioni, e diligenze, usate da questo Insigne
Proconsole, non che la probità, ed il zelo dimostrato nell'ammini-
strare la Giustizia, con ogn' altro pietoso soccorso ai Sudditi
di Sua Reggenza, spiegano a chiaro lume l'indole felice di un
genio destinato a gouernare con applauso per la sua rettrezza,

(*) Voir *Isis*, 11, 343-363.

ed a trionfare delle più moleste insorgenze per la Costanza Eroica, con cui si / è dato a combatterle, sino dal primo istante dell'Arrivo suo nella Dalmazia.

Avendo egli dato appena la Mano alle redini della Spinosa Reggenza di sì estesa Provincia, si vidde in pericolo di dover sostenere la Gverra, qvale apertamente si comprendeva negli Strepitosi apparati (2) della Turchia; e si vidde ad un tempo stesso costretto a provvedere gli opportuni ostacoli all' incendio Contagioso della Bossina, dove manifestatosi sino dall' Estate del 1762 nella Città del Serraglio (3) Capitale di quel Regno, si avanzava poi con veloce passo, e Stragge, a minacciare li nostri Confini colla sua Mortale infezione.

Pure a fronte dell' orrido aspetto, che gli presentarono la Gverra, e la Fame, colla Peste unita, egli senza punto alterare quella Serenità d'Animo, che l'intrepido Eroe conserva nell' orror delle Battaglie, si fece ad approntare quanto richiedeva la resistenza difensiva per la Gverra, e provvedere ciò, che servir doveva, per debbellar la Fame, qvale non meno degl'altri dve Flagelli, temer faceva l'eccidio della sua Popolazione.

Indi senza interporre Momento di ritardo alle disposizioni, che preservar dovevano la Provincia dal / Malore Contagioso, destinò quanta Milizia le fù possibile alla Custodia, e difesa di tutto il Confine, che abbiamo coi Turchi; ma continuando il Comercio con essi, ed il frequente passaggio della Caravana (4) per li Borghi di Spalato, vi furono nell'Ottobre del 1763 insinuate di Contrabbando alcune Schiavine con Lana infetta, ed insieme la Peste.

Questa vi fece immediate il suo Attaco ad alcune Famiglie nei primi giorni del Successivo Novembre (5), senza per altro dimostrare altri Segni alla Cute, che quelli dell'ordinaria Febbre Maligna, dimodocchè, non essendo conosciuta la qualità rea di tanto malore, diffuse la Contaminazione del Suo Veleno a molte Case del Borgo Grande (6), e diede anche la Morte a Sessantacinque Persone, prima che si dicesse Peste.

Veramente anche la Febbre Maligna, quantunque non si consideri di quella Natura, che ordinariamente porti le qualità della Contagiosa, ella però si dourebbe trattare con sommo rigvardo, stante la grande affinità, che frà loro tengono, e massime quando si estende a formar Epidemia.

Già si sà, che li Sintomi naturali all'una, sono anche / relativi all'altra, come in esempio li dolori acuti di Capo, il delirio della Mente, l'ardore interno, coll'arsura, e scoloramento delle Labra e Lingva, non che le Pettecchie per la Vita, coll' espulsione di qualche Carbone, oltre i Tumori sotto le orecchie, che si dicono Parotidi nella Maligna acuta, e nella Contaggiosa detti vengono Buboni, ovunque sieno, cioè nel Sito delle Parotidi, egualmente che sotto le Ascelle, o Angvinaglie.

Di più ancora Sappiamo, che la Febbre Maligna si comunica per contatto, e mediante la contaminazione degl'Aliti rinchiusi; e per contatto, e per la mala qualità degl'Aliti Contaminati, e corrotti, si comunica la Peste da un Vomo all'altro.

Questa però differisce da quella, tanto per l'Aumento della Malignità, con cui dà la Morte in pochi giorni, ed anche in ore, quanto per la maggiore attività, che tiene d'insinuarsi a quelli, che senza grandi risserve toccano (7) la roba, o le Persone appestate.

Dalla differenza della rispettiva Malignità ne deriva, che la prima suol tramandare le Pettecchie alla Cute il Sesto, ovvero il Settimo giorno del Male; Ma la Febbre Contaggiosa tramanda Bubboni, e Pettecchie alla Cute / il secondo giorno del Malore o tutto al più nel terzo.

Qualunque però fossero gl'Aspetti, e qualità del Male, che forma l'oggetto del nostro discorso, convien credere per buona ragione, che nel suo principio non fosse con tutto l'aumento della Malignità Contaggiosa, mentre il Medico CASTELLI (8), e suo Chirurgo SILOVICH (9), con li molti Religiosi, che amministravano li Sacramenti agl' Infermi, toccarono senza risserva, e senza contrarre alcuna disgrazia.

Di più ancora, e sarà per puro effetto della Divina Misericordia, si viddero illese dall'Infezione moltissime di quelle persone, che in buona fede, appunto secondando la volgare usanza del Paese, bacciarono li Morti nei consueti piangimenti, sino a tanto che il Male cangiò nome.

Fattasi poi riflessibile la Mortalità, che giornalmente cresceva nel Borgo Grande, coll' Eccidio d'alcune Famiglie, presero quei Miseri a sospettare, che l'Eppidemia fattale, non fosse più quella Febbre putrida Verminosa come da Medici era definita, ma fosse anzi la vera Peste.

Rivolti dunque al Soccorso Celeste, come il più efficace, implorarono con divvota preghiera l'intercessione della Beata Vergine, per ottenere la grazia di riconoscere la qualità del Male, che gl'affliggeva, e furono Esauditi. /

La Mattina dei diciassette Dicembre, si condusse processionalmente la Sagra Immagine di Poissan (10) nella Parrocchia del Borgo Grande, ed ivi restò Esposta tutto il giorno diciotto; e la susseguente Mattina, si videro li Segni manifesti della grazia ottenuta, risultando li Bubboni, e li Carboni agl' Infermi, ed anche alli Morti la Notte innanzi.

Non restando più dubbia la Mala qualità del Morbo, si presero da S. E. il Sig^r. ANTONIO DELFINO (11) Conte Capitanio di Spalato le più addattate misure, onde poter contribuire le istantanee providenze di riparo all' Aumento Contaggiato, e rendere ancora sollecitamente del funesto accidente, avvertita la suprema Carica Generalizia.

Devesi dire per la verità del fatto, che la Città di Spalato è debitrice della propria Salvezza alle prudenti, e saggie disposizioni del riferito Nobile Soggetto; poichè avendola segregata dai Borghi a buon'ora, usò tutte le necessarie Cautele, per custodirla da ogni contaminazione illesa, come felicemente le successe.

Col mezzo poi del grandemente benemerito Colonello MAZUCCATO (12), fece dividere il Borgo Grande dagl'altri, e stabilire istantaneamente l'Ospedale per la Gente infetta, nonchè far condurre nei Castelli di San Stefano, e Capogrosso (13) le / Famiglie, a quali era necessaria la Separazione, e l'espurgo per le disgrazie accadute in Casa loro; e diede alla popolare indigenza il necessario soccorimento, sino all'arrivo salutare della Suprema Carica Generalizia.

Pervenuto a Zara l'annuncio ingrato della Contaggiata fiamma, che ardeva li Borghi di Spalato, l'Eccellentissimo Signore Provveditore Generale, con la naturale operativa sua diligenza, e con la prestezza relativa all'urgenza del caso, riunì tutte le materie di Soccorso, che gli furono possibili, e ne fece con Bastimento espresso l'opportuna spedizione a quella parte. Indi preso l'imbarco Sopra la Gallera del N. H. Signor MATTIO PIZZAMANO il giorno 27 di Dicembre, partì senza ritardo, mà per la contrarietà

del tempo burrascoso, le convenne di far un Viaggio sempre remigando, cosicchè a stento grande si potè arrivare a Spalato il giorno dei qvattro Genaro.

La comparsa della Suprema Carica a qvelle Rive, fù Solleennizzata dalle Comuni acclamazioni della Città e Borghi, mentre le speranze di qvei Suffraggi, che niun' altra mano poteva contribuire alle angustie loro, erano tutte riposte nella riverita presenza di chi regge con pietoso nome al Generale governo della Provincia.

La di loro aspettazione, non fù defraudata in alcuna parte. / poichè segvito appena l'arrivo di Sua Eccellenza nei Lazzaretti (14) della Città, egli si fece qvall'Amoroso Padre, a riconoscere immediate lo Stato, ed il bisogno della popolazione afflita, sovvenendo con generosa dispensa gl'Infermi dell' Ospedale, non chè la povera Gente, ch'era ristretta nei Lazzaretti Campestri, e di risserva. Poscia vi unì la Caritatevole Amministrazione (15) del Pubblico Biscotto alle indigenze dei più Miseri nei Borghi, e diede tutte le sue applicazioni a frenare nei modi possibili l'Aumento giornaliero, che la Contagghiosa pestilenza vi faceva con somma stragge.

In Seqvela poi di qvanto le fù esposto intorno alla grandezza del pericolo, che minacciava l'universale dei Borghi, e massime quello di S. Croce dove già languivano Colpite dal malore più di sessanta Famiglie, diffuse le opportune prescrizioni, e regole da osservarsi nella Contagghiosa Epidemia; ed impose ai trasgressori delle di lui Salutari ordinazioni qvei Castighi, che con Paterna Severità reputò necessari da far esegvire, quando la scorrettezza di qualche sconsigliata persona violasse l'osservanza di sì venerabile comando.

Indi senza togliere dalla forza, che custodiva la grand'estesa del Confine col Turco, e degl'altri Appostamenti / di egval gelosia, dispose tutta la Milizia Oltremarina, qvale fù possibile di avere alla sua obbedienza, e fece armare ovunque richiedeva l'impegno della Materia; intersecare la Clandestina Comunicazione dei Borghi frà loro; ed estendere una Linea dalle Botticelle (16), sino al Mare, dove sciiede il Convento dei Paludi (17), acciò niuno ardisce uscire dai Borghi, se non a pericolo di passar per l'Armi. (18)

Così appunto richiedendolo la grave materia della commune Salute, ne fù appoggiata l'esecuzione alla nota esperienza del Tenente Colonello PIETRO RRADO (19), qvale in figura di Sovvrain-

tendente della Linea, invigilar dovesse per l'adempimento di quanto le veniva prescritto nella sua Istruzione, onde togliere al di fuori gl'Arbitrj della Mescolanza Clandestina, giacchè per tutto quello riguardava la dirrezione interna dei Borghigiani, n'era incaricato il Territoriale Colonnello MAZZUCATO, che in ogni tempo vi corrispose col pieno gradimento di chi comanda.

Fù parimente destinato l'occorrente Pressidio alla custodia dei Lazzaretti, ove si ponevano in risserva le Famiglie, a qvali era successa una qualche disgrazia di contaminazione, e per le occorrenze interne dei Borghi, vi furono disposti 200 Soldati, con rispettivi Vfficiali della Fantaria Ittaliana. /

Con la Scorta di si regolari disposizzioni dirette ad impedire l'Aumento della Contaggiosa Infezzione, e con qvella dei presservativi, e degl' altri efficaci Medicinali suggeriti dai Celebri Prottomedico PINELLI (20), e Medico Fisico Generalizio Dr. SAJANO (21), si lusingava di veder agevolato il gvarimento degl' Infermi, e frenata la dilatazione dell' attacco pestilenziale, mà la Fierrezza del Morbo, continuando la violenza del suo Carrattere Maligno, rendeva inutile la virtù d'ogni medicamento; e la proterva genia di Molti Borghigiani sprezzando li Salutari divieti, e l'orrido aspetto del male stesso, sembrava condotta da impulso bestiale, a dar giornaliero fomento al focco, che la consumava.

L'accrescimento della infezzione nelle Famiglie del Borgo Grande, qvale in quindeci giorni dopo il nostro arrivo, aveva già raddoppiato il numero delle Case colpite, pose in angustie somme l'animo pietoso di questo Esimio Proconsole; mentre le convenienze della primaria sua Carica, lo costringevano a tenersi di Libertà per accorere, ovunque le urgenze della Provincia l'avessero chiamato, e la grandezza dell'incendio, che ardeva i Borghi, con apparenza d'incenerirli del tutto, non richiedeva meno, che la Virtù presenziale, coll' immediato soccorso di tutta l'autorità sua per estingverlo.

All' amarezza, che caggionava l'Aumento giornaliero del Contaggioso furore, se vi univa la scarsezza dei mezzi necessarij a rittenerlo in freno; mentre li provvedimenti da soccorso quantunque generosamente apprestati, più non corrispondevano all'urgenze del male sommamente ingrandito.

L'evvidenza de suoi funesti effetti, avea talmente sorpreso l'Animo di tutti, che non vi era più, chi ardisce di fare un Passo nel Borgo

Grande, senza trepidar la Morte; cosicchè crescendo del pari la confusione, colla Stragge, non si poteva neppure sapere il positivo numero dei Feriti, e Morti, ovvero quello, che ne accertasse la quantità delle Fammiglie infettate; quantunque il Colonnello MAZZUCATO, a cui era diretta la somma delle ispezioni, usasse le possibili diligenze, per corrispondere anche in questo ai doveri del suo incarico.

Vedendo l'Eccellentissimo Signor Provveditore Generale, che gl'esperimenti fatti sino allora, non corrispondevano, secondo la maturità delle di lui prudenti disposizioni all'importanza di Salvare tanta popolazione, quale miseramente langendo periva in vista sua, si determinò di mandare nei Borghi colla Souraintendenza Generale alla Sanità la persona / del Colonnello PAGANELLI ZICCAVO (22), che sosteneva da più d'un anno appresso la di lui Suprema Carica, la Figura di Maggiore di Provincia.

Questo Ufficiale, che ha sentimenti onorati, e buona vocazione, si rassegnò all'autorità del Comando, ed alla premura di contribuire tutto il miglior Servizio, che le fù possibile al venerato suo Principe; ma conoscendo egli la poca sua capacità, e l'inesperienza sua nel grave gelosissimo incarico della Salute; e sapendo pure, quanto troppo era dilattata nei Borghi la Contaminazione della Peste, diffidava del buon'esito nel periglioso cimento, a cui veniva destinato.

Ad ogni modo senza Smarirsi nel riflesso dell'arduo impegno, che doveva incontrare, combattendo l'orrido Nemico della Vita Umana, passò nei Borghi ai 23 di Genaro, unitamente al Capitano GEROLAMO SMACCHIA, quale se gli concesse in qualità di Assistente, come un Ufficiale necessario ai bisogni della circostanza; sia per la cognizione della lingua Nazionale, che per le altre doti, che possiede onde poter corrispondere il miglior Servizio ad ogni Publica Commissione.

Ridottosi dunque l'accennato Colonnello a prender domicilio nel Borgo detto Pozzobono (23), per essere quello meno contaminato degl' altri, ed a portata di poter accorrere ovunque fosse / il bisogno della presenza, o degl' ordini conferenti all'urgenza dell'afflitta popolazione, si fece a riconoscere l'estesa della Linea, che risserava i Borghi colle separazioni armate frà l'uno, e l'altro; ed approvando quanto era fatto dall'esperienza del Tenente Colonnello RADO, gl'additò quel di più, che al proposito conveniva,

onde per difetto delle occorrenti Sentinelle nulla insorgesse a danni della Salute, o contrario alle prescrizioni riverite della Suprema Carica.

Il giorno susseguente al suo passaggio nei Borghi, si portò egli col suo Assistente Capitano SMACCHIA, unitamente al Colonnello MAZZUCCATO e Medico CASTELLI, a visitare nell'ospedale l'Infermi, che al numero di 41 vi langvivano colpiti da Morbo Contagioso; e dopo rilasciati gl'Ordini conferenti alla possibile miglior cura di quelli, si rivolse a praticare la diligenza necessaria, per verificare nei giornalieri Rapporti all'Ecc^{mo} Sig^r. Prov^r. Generale la precisa quantità delle Famiglie contaminate, qual si trovavano ascendenti al numero di 120 oltre le Case Sospette, che al numero di 90 erano cadute in risserva.

Ad oggetto poi, che dalla innavertenza di contrassegnare le Case contaminate dal malore, non avesse a derrivare un qualche maggior danno alla gente, a cui, stante la quantità delle Case infette, non fosse talvolta nota la disgrazia par/ticolare di tal una, e massime nel Borgo Grande, ove già se ne contavano 112, fece che per Sestiero, e con distinto numero di colorito rosso, venisse marcato (24) il traverso Superiore d'ogni Porta delle Case colpite, serrando inoltre a Mura secca tutte le Porte di quelle, nelle quali mancavano gl'Abitatori, essendo estinti, ovvero passati nella risserva dei Lazzaretti.

Dopo riconosciuto il totale quantitativo delle Persone, ed anche delle Case contaminate con le sospette, e postevi le Sentinelle, che la Forza della Fanteria permeteva, prese in esame tutti gl'ordini prescritti dall'Ecc^{ma} Suprema Carica, per farli eseguire coll' oggetto Salutare di rimuovere, come successe la funesta mescolanza, che dalla popolare Sfrenatezza veniva praticata; ne abbastanza saprei dire il giovamento, che vi produsse la severità usata dal Colonnello ZICAVO, nel mettere in disciplina un Popolo costumato a viver disubbidiente per naturalezza indomita, o per tolleranza troppo blanda dell'ordinario Comando.

Alla cura poi di mettere in Disciplina la scoretta Plebbaglia delli Borghi, vi unì quella di togliere al più presto, che fosse possibile ogn' incentivo alle successive Contaminazioni, cioè di far passare nei tre Lazzaretti Campestri le Famiglie tutte, / che si dicevano infette, Tradurre la roba loro in un solo Magazzino (25) appartato, e ben custodito, e far esporre all'aria, col giornaliero Maneggio

tutta la roba delle Case Sospette, per aver praticato colle Famiglie, a qvalli era insorta qualche disgrazia del Morbo Contagioso.

Poscia in relazione agl' Ordini Salutari di S. E. Prov^r Generale, si obbligarono le Famiglie tutte a star serrate nelle rispettive Case, il periodo intero di 40 giorni (26), permettendo al solo Capo della Casa il sortir fuori con una Servente, a prender Acqua, e provvedersi l'occorente alla Sussistenza, e ciò nelle ore, che venivano indicate Sera, e Mattina, con il suono d'una precisa Campana; e si provvide ancora il modo di regolarmente suffragare le Famiglie, a qvalli era vietato in ogni tempo l'uscir di Casa, per esser infette, o Sospette.

In sequella dei metodi concertati per l'effetto delle riferite providenze, si stabilì quello pure, che occorreva per macinare le Biade Spettanti alla Città, e Borghi, poi quello di condurle colle dovute Cautelle ai Molini di Salona (27), ove al Capitano GIO. ARNERICH (28), che ritrovandosi coll'incarico di Sovrantendente al geloso ufficio di scortare la Caravana, e custodire la Confinazione di quel Territorio, si aggiunse l'ordine di prestare le Benemerite sue diligenze ancora in qvesto; / acciò doppo tutto, si vi portassero le Farine alle Stangate, senza violazione dei buoni riguardi della Salute, come con distinto merito dell'esatta vigilanza dell'Ufficiale riferito, fù sempre praticato il miglior ordine, che da lui esigere poteva il Publico Servizio.

Nel periodo riferito dei 40 giorni dell'universale risserva, non fù permesso ad alcuno l'andar vagando per le Strade, se non a qvelli, che alla sfilata, e senza Gabbana, o Tabbarro dovevano uscire di Casa per le rispettive occorrenze; nè tampoco si officiavano le Chiese, se non a porte serrate, e senza l'intervento de Secolari, o suono delle Campane, acciò col pretesto della Divozione, non si avessero a fare le consuete radunanze (29) qvalli sin' allora, in fede d'esser Sani, avevano fatalmente dilattata la Contagiosa infezzione.

In coerenza poi delle attenzioni, che richiedeva la Salute Spirituale delle Persone angustiate a Morte, si provvide al metodo con cui li Relliggiosi dovevano Sacramentare gl'Infermi alle Porte degli Spedali, e delle Case, ove insorgeva il bisogno di farlo, cosicchè la pietà Ecclesiastica senza incontrar disgrazie del Malore, non mancò gl'opportuni soccorsi ai Moribondi, qvando lo permise la fierezza del male, che ne uccise più d'uno in poche ore.

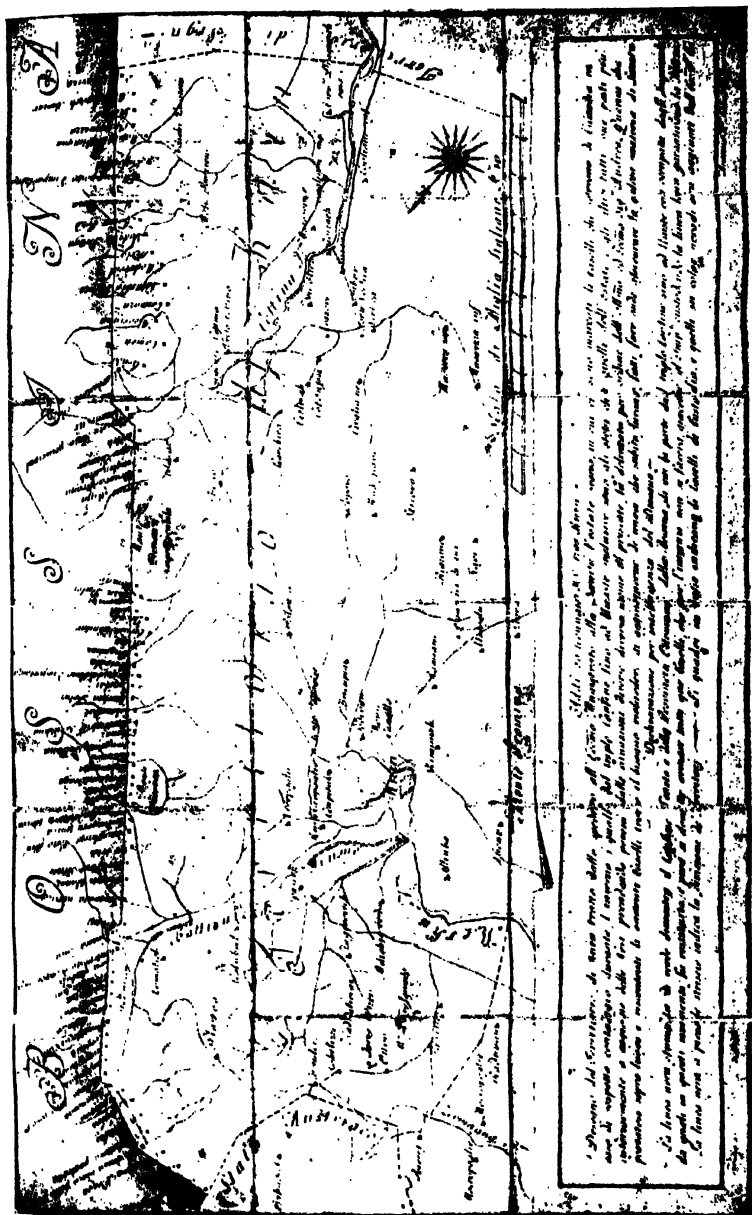
Si provvide ancora (30) ai modi necessarj per condurre i Morti / con le dovute cautele, tanto qvellí dei Borghi minori alle Botticelle, quanto qvelli del Borgo Grande a S.to Steffano, dove si seppellivano nudi, e separati nella rispettiva bucca, profonda, e lunga cinque piedi crescenti, con molta Calcina viva, unita alle ceneri dei Vestimenti loro, qvalli si ardevano intorno alla Sepoltura, e poi da Beccamorti si gettava il tutto nella Fossa, e si riempiva di terra ben compressa, sino al di sopra dell' ordinaria Superficie del Campo, acciò mai tramandasse il mal' odore della pestilenza.

Alle cautele usate per seppelir i Cadaveri umani, si unì quella di far interrare tutte le Bestie (31) uccise per edito Salutare nei Borghi, qvalli essendosi lasciati con trascuratezza infracidare su la Riva, e per li Campi prossimi all' Abitato, tramandavano un fettore, che certamente offendeva; mà la confusione, che seco portava l'orridezza della Peste, scusava l'abbandono delle migliori precauzioni, che dovevano usare; e faceva, che tutti gl'esposti al pericolo del Velenoso attacco, mancassero il necessario discernimento all' occorrenza maggiore.

A seconda poi delle buone direzzioni prese, onde frenare l'aumento del Contagioso Morbo, si fecero praticare / Sera e Mattina per tutte le Case Abitate le depurazioni dell' Aria con Fuochi (32) d'odorosa Boscaglia, in vista di preservare la Gente dalle contaminazioni derivative dalla malignità dell'influenza, e si fece ancora, che tutta la robba capace di contrarre la pestifera corruzione, fosse maneggiata, ed esposta tutto il giorno alle Finestre, ed altri luoghi ariosi di ciascheduna Casa.

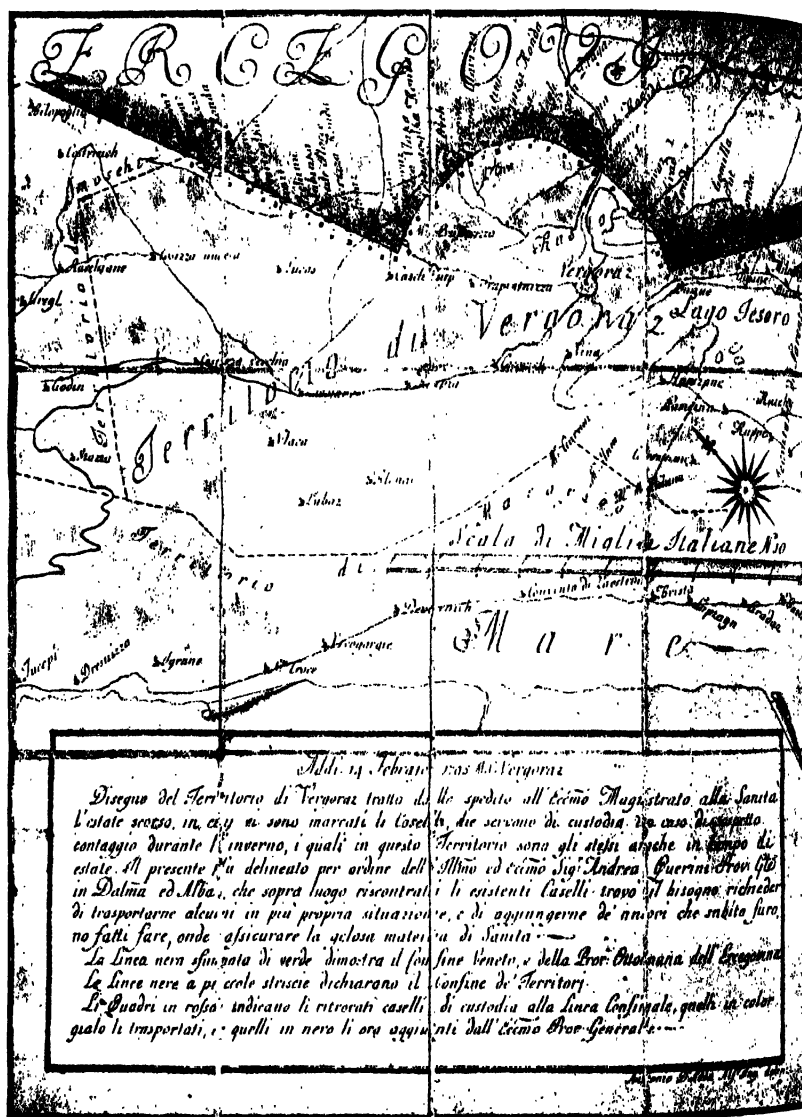
E perchè nella trepidazione, ed abbattimento d'Animo, in cui erano tutti, non venivano praticate, come si doveva le giornaliere Visite di ciascheduna Casa, col riscontro specifico d'ogni Persona; così fù regolato di maniera, che il tutto dovesse corrispondere col buon effetto agl' Ordini di Sua Eccellenza ed alla commune Salute dei Borghi, a cui erano diretti.

Infatto mancando della necessaria diligenza qvei Deputati, ai qvalli era incaricato il geloso ufficio di riconoscere giornalmente lo stato di tutte le Fammiglie del rispettivo sestiero, ne portava di conseguenza, che alcune Persone, avendo attorno il morbo Contagioso, senza notificarlo (33), dillattavano impunemente l'uno all'altro il suo Veleno mentre qvelli ai qvalli era insorta la disgrazia dell' attacco in luogo di palesare l'accadutale sventura, la nascon-



TERRITORIO DI KNIN





TERRITORIO DI VERGORAZ.

devano a bello Studio nella dolce lusinga di superarla senza patir danno nella roba, / e senza essere condotti all'Ospedale, che avevano in orrore, stante li molti pocchi, che da quello avevano la sorte di uscirne vivi.

12^r

Ad oggetto dunque di rimediare nel possibile miglior modo al disordine riferito, si diede l'incarico agl' Ufficiali destinati nei Borghi di dovere ripartitamente unirsi ai Deputati, che dissi, e seco loro portarsi ogni Mattina, colla rispettiva nota (34) delle Persone da riconoscere Casa per Casa, non che colla istruzione dei segni da rimarcare nell'esperimento della Visita, onde saper distinguere chi avendo il male, cercasse di nascondarlo alla di lui osservazione, poi farne il giornaliero Rapporto in scritto al Sovvrantendente ZICCAVO, spiegando così bene lo Stato di Salute, che gl'accidenti particolari del Sestiero appoggiato alla di lui pontualità, ed onoratezza.

La nota conteneva li Nomi, coll' età di ciascheduna Persona, quale ci costò molta pena per poterla formare veritiera, essendocchè gl'Uomeni usando tre Sopranomi, ne cangiavano a piacer loro uno, e ciò per diffcultare alla Giustizia la verificazione Personale, quando vengono detenti, o inqueriti per le loro criminalità.

L'istruzione conteneva l'incarico di dover al tocco della Campana indicante la Visita, far sortire Casa, per Casa/ tutte le Persone chiamate dalla Nota consegnatale al proposito, e farle stare in Spalliera fuori delle Porte rispettive, indi riscontrare li nomi coll 'età di ciascheduna, e farle passeggiare separatamente alquanti passi, onde rilevare dal portamento del Corpo, dall'Occhio allegro, e chiaro, dal colorito naturale del volto, dalla lingua, e labbra la di loro buona Salute, e far poi che ciascheduno si battesse per se stesso sotto le Ascelle, ed Anguinaglie coi pugni, acciò vedere se nell'azione vi fosse ripugnanza, o qualche indizio del Dolore, battendosi la parte offesa.

12^v

Qvallora poi avessero rimarcato in alcuna persona li Contrassegni, che servono a dinnotare il Male, cioè il passo incerto, come la Gente presa dal Vino, il Viso con pallidezza oscura, l'occhio dimnesso, immobile ed incapace di gvardar la Luce, arscia e bianca la lingua, colle labbra, interrotto ed ansante il parlare; In quel caso conveniva di far nudare la Persona, che dato avesse

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gl'indicati Sospetti, ed osservar con ogni diligenza, se manifestasse Pettecchie, o Carboni per la Vita, così pure Tumori detti Bubboni nelle Angvinaglie, sotto le ascelle e nelle Glandule Parotidi, ed in ogni modo separarla dalla Famiglia, e dar parte a chi si disse, per quelle successi/ve diligenze, che la cautela della gelosa materia richiedeva.

Dall'osservanza dell'ordine incaricato all' onorata pontualità di quelli Ufficiali per le Visite successive, ne risultò poscia la certezza di sapere giornalmente lo Stato positivo d'ogni Famiglia dei Borghi, e si tolse a quella sconsigliata Plebbaglia l'arbitrio funesto di più nascondere il fero Mostro, quale per timore di farne riconoscere l'orridezza nel primo attacco delle rispettive Case, lasciava come stupida, che divenisse l'estirpator Crudele delle sue Sostanze, e Vita.

Posto coi modi riferiti un qualche rittegnò ai maggiori progressi del Pestifero Malore, si rinforzarono le possibili diligenze acciò rendere sempre più utili, ed esegvite le Salutari ordinazioni, e regolamenti della Sublime Intelligenza di questa Suprema Carica Generalizia, e si diede tutta l'attenzione a concertare i mezzi necessarj, per togliere all'avvenire ogni velenoso dilattamento a nuovi accidenti, che dall' estesa della contaminazione si dovevano temere.

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In vista dunque di corrispondere col beneficio degl' effetti alle caute disposizioni di Sua Eccellenza si fabbricarono al di fuori del Castello di Capogrosso, e nel Campo delle Botticelle molti Caselli di Tavole (35), capaci di contenere quattro persone, / sino a dieci l'uno, oltre li Tinacci, che pur vi furono apprestati ad uso d'una, ed anche di due, o tre persone in ogn' uno, ed il tutto fù situato in quadrilungo colle dovute segregazioni fra l'uno, e l'altro, e colle Barriere dei Cavalli di Frisa interne, ed esterne, e colle opportune custodie Militari, acciò venissero rispettati colla gelosia, che meritavano li Comandi, e le regole spettanti alla Salute di tanta Gente.

Terminato l'espresso lavoro con tutta la Sollecitudine, che permise la difficoltà di poter unire l'occorrente materiale, cogl' abiti necessarj all'espurgo di tante Persone, si fecero cautamente tradurre in Dettaglio, ed alla sfilata negl' indicati luoghi tutte le Persone, a quali era successa qualche disgrazia, dopo le prime alla rifusa spedite nei Castelli, avanti l'arrivo a Spalato della Carica Generalizia. •

Ricapitate, ch'erano le Famiglie ai luoghi della Salutare risserva, si facevano ad una per una Spogliare in sito riparato, e cauto, ed indi ben lavate per tutto il Corpo con fervoroso acceto, si rivestivano cogl' Abiti provveduti dalla carità Pubblica, e si conducevano ad abitare nei Caselli, o Tinacci, corrispondenti al numero delle persone, che componevano ciascheduna di quelle Famiglie.

Con pari diligenza, ed a vista della benemerita deputazione / del Colonnello GIORGIO TVELLIO (36), che sovrastava per il Colleggietto alla Sanità del Lazzaretto del Castello di Capogrosso, si facevano anche raccorre dai Bastaggi Sporchi gl'Abiti, e le Robbe ad uso asportate dalle indicate Famiglie, onde far praticare l'espurgo d'immersione nel Mare alla Robba, che non perdeva il Colorito, ed indi farla estrarre dopo 96 ore dai Bastaggi Netti, acciò riconsegnarla a proprietarj, da che avessero terminati due punti della prima Qvarantena senza novità Contaggiosa.

14^r

Alla riconsegna della Robba espurgata, succedeva il recupero della Pubblica, onde ripurgarla per le urgenze di quelle Famiglie, che successivamente furono colpite dal Flagello, e traddotte così bene a Capogrosso, che alle Botticelle, dove pure sotto la dirrezione del Rispettivo Deputato agl' Espurghi si praticarono tutte le Regolari diligenze, e l'esattezza del metodo, che sopra dissi.

A seconda poi del beneficio, che seco portavano li metodi stabiliti nella pratica delle cose riferite, conveniva di dar tutta la mano all' estrazione delle robba dalle Case infette; come l'opera egualmente pericolosa, che di somma importanza, e forse la più difficile da condursi al suo buon termine, poicchè restando essa più a lungo nelle disabitate Case incitava gli Scelerati / alla reità del Furto (37), ed a condurre al suo eccesso la Contaggirosa fiamma; ma la quantità della materia, e li rigvardi annessi al suo maneggio erano tali, che non potevano, se non ritardare ogni regolato solleccitamento alla gelosia della grave operazione.

14^v

Ad ogni modo pressando l'importanza di dar cominciamento alla condotta della robba contaminata nel Magazzino, che dissi appartato dalle Abitazioni, e sotto la custodia di più Sentinelle, si prepararono molto Carrette, o come le dicono Civiere da mano, con sue Coperte di tella incerata, e sacchi della stessa robba, Rampini di Ferro, Spontoni, e Ronchette astate, non che gl'abiti di tella grossa, e Catramata, per uso dei Bastaggi (38) Sporchi,

quali consistevano in un Camisotto sino al ginocchio, col suo Cappuccio, e Braghese sino a mezza Gamba, stivaletto sino a mezza Coscia, Gvanti della stessa robba, e Scarpe di Bulgaro cucite allo Stivaletto, e Catramate al di fuori del suo Contorno.

In conformità della preparazione alla riferita urgenza, si destinarono tre Deputati co' suoi Fanti, tre Gvardiani Veneti della Sanità, dieci otto Soldati volontarj per Bastaggi Sporchi nel Borgo Grande, oltre li 6 Beccamorti, e cinque tra Infermieri, e Serventi dell'Ospedale, con 4 Bastaggi netti, che già vi erano, e si destinò parimenti un Deputato / con un Gvardiano Veneto, e 6 Bastaggi sporchi, con tant' altri netti a Luzaz, per l'espurgo dei tre Borghi minori oltre due Serventi, e 4 Beccamorti ad uso del Rispettivo Spedale.

Li Deputati agl' Espurghi, furono incaricati di far inventariare col mezzo di qualche Relligioso tutta la Robba, che dai Bastaggi Sporchi veniva estratta dalle Case infette, acciò si sapesse dopo l'espurgo, a chi era dovuta; e perchè meglio, e più facilmente riuscir potesse l'esecuzione, si ripartirono per Sestiero quelli del Borgo Grande, e se gli diede Separato luogo nel Magazzino per farvi recapitare la Robba delle Famiglie spettanti alla rispettiva dispensa come pur fece quello di Luzaz, che in luoghi distinti raccolse quella dei tre Borghi minori.

Divvenuto poi grandemente Serioso l'impegno dell'Espurgo del Borgo S^a Croce (39), ove la Contaggiosa infezione aveva già manomesso 139 Famiglie in 165 Case, oltre le 91 cadute in sospetto, per la rellazione, o pratica tenuta colle infette. Si persuase il Colonnello Zicavo di appoggiare la particolar sovran-tendenza / e direzione al molto Benemerito Sargente Maggior PIETRO PETROVICH (40), qvale riconosciuto per un Ufficiale, fornito di capacità distinta, e del più onorato Zelo per il Pubblico Servizio, vi corrispose anche con esattezza, e sollecitudine pari al desiderio, ed insieme al bisogno del grave affare.

Veramente la grandezza del pericoloso assunto, faceva trepidare tutti quelli, che dovevano assistere all'Ufficio dei Bastaggi Sporchi colla presenza, e nel principio dell' estrazione della robba dalle Case infette, si operava con timorosa lentezza, e confusione, mà presa poi dai Bastaggi, e Suoi Assistenti quella confidenza, che

dona l'esperimento al successo delle Cose, si diede un regolato compimento all'opera di condurre tutta la robba ove conveniva, e si lasciarono a buona cautella tutte le Finestre delle Case infette aperte, onde vi scorresse di libertà l'Aria più sana del moto esteriore.

Per tanto che i Deputati agl' Espurghi, attendevano all'Opera dei Bastaggi nei Ripparti, che gli furono assegnati, si diede anche ai Gvardiani Veneti l'incarico di personalmente visitare ogni Mattina tutte le Case poste in risserva per sospette, acciò in presenza loro, si praticasse / a tenore delle Salutari prescrizioni di S. Eccellenza il maneggio, e ventilamento delle robbe Soggette alla contaminazione, affinchè col mezzo d'una esperienza esatamente replicata per 40 giorni, ne risultasse con certezza la Salute di tante Famiglie, che sino allora ci era stata dubiosa, e sospette per le ragioni addotte.

16*

In aggiunta dell' incarico riferito, appoggiato come dissi alla diligenza degl'esperti Guardiani Veneti, se gli diede quello ancora dell'espurgo di tutte le Case, che al numero di 184 furono contaminate nei Borghi, senza gli Spedali, ed allogio dei Beccamorti, ed alla esperienza del di loro ministero, fù poscia raccomandata la ventillazione di tutta qvella robba, a cui l'espurgo d'immersione poteva inferir danno, sia per il Salso dell' Acqua marrina, che logorava la robba stessa, e massime la più usata, e sia perchè nell'acqva espressa, venivano smarrite le marche di quelle Persone, ai quali erano dovute.

Ridotta poi come dissi tutta la Robba in un sol Magazzino, si fece nuovo riscontro della qvalità particolare, e si fece tradurre a San Stefano, reso libero dalle Famiglie, che vi erano in risserva tutta la Drapperia della miglior / qvalità, e condizione, ma distinta in ogni Capo colle Marche del proprietario rispettivo, ed ivi col mezzo degl'occorenti Bastaggi, diretti dai Veneti Gvardiani, venne praticato l'espurgo della materia Sospetta, usando profumi forti, e dolci, manneggio, e ventilazione per giorni 60.

16*

L'espurgo del Pellame, che per la sua qvantità non poteva capire nel Castello di San Stefano, fù praticato come sopra in quello di Capogrosso, da che si posero in libertà le Famiglie rinchiusesi nel principio del Contaggio, ma quello di tutta l'altra robba di pocco valore, si fece per immersione, o bollitura, ove lo permetteva la Cautela della materia, e le urgenze, della misera Gente; qvantunqve la Cavàna di Luzaz fosse la più capace, ed

anzi quella, ove si terminò con ordine migliore l'espurgo generale per immersione.

17* L'espurgo delle Case, quale si fece immediate dopo di averne estrata la Robba, fu l'oggetto di tutta l'attenzione degl'Assistenti e particolarmente dei Veneti Gvardiani, onde al caso di farle riabitare, non vi fosse il minor dubbio, che dalla trascuratezza dell'opera, più rinascessero quei funesti accidenti, dei quali si poteva temere, stante / la difficoltà, che seco portava l'impegno della gelosa materia per le sue conseguenze: Ma l'esito riuscì felicemente in ogni espurgo, a lode di chi prescrisse i metodi, ed anche a merito di chi ebbe l'onore di farli eseguire.

Il metodo (41) di espurgare le Case, fù regolato coi rapporti della qualità delle Fabbriche, cioè in quelle di Mura verde, o sia in Calcina con più appartamenti, si mettevano dai Bastaggi Sporchi alcune Pignatte di terra ben cotta, nei diversi luoghi della Case, con entro li Profumi forti, composti di Catrame, Solfere in tocco, e d'altre materie di odore acutissimo; poi si attaccava il fuoco ai profumi, che ardevano il periodo di ore 24, tenendo serrati li fori tutti della Casa, e dopo si aprivano li fori espressi, onde vi scoresse l'Aria esteriore, per lo spazzio di ore quarant'otto.

Indi si replicavano li Profumi col metodo riferito, e dopo si faceva scorrere l'aria di libertà per tutta la Casa, durante lo Spazio di 4 giorni; poi fatto questo, si lavarano le Mura, li Travi, ed ogni Tavvolato con acqua di Calcina viva, ovvero di mare, in difetto della prima, e con ciò era finita l'opera dei Bastaggi Sporchi. /

17* Dopo vi entravano li Bastaggi netti coi profumi dolci, composti di bacche di ginepro, e d'altre cose di odor gradito, e serravano come prima li fori tutti per il tempo, che occorreva, onde s'insinuasse il buon odore del profumo per tutto l'interno della Casa; e qualora vi fosse rimasto l'odore dei profumi forti, ovvero ne restassero denigrate le Mura si replicavano li Profumi dolci, e s'imbiancavano le Mura con Acqua di Calcina Morta, poi si lasciavano aperte le Finestre, colle Porte 15 giorni almeno, prima di riabitarle, ed era così terminato l'Espurgo d'ogni Casa infetta.

Nelle Case a piè piano, si brustolavano li Travi, coi Tavolati e tutta la Superficie scabra della mura interna, poi se gli mettevano gli profumi forti, otturando gli fori, per dove uscir poteva il fumo; e dopo replicatolo la seconda volta dai Bastaggi Sporchi,

e col metodo di sopra espresso, si lavavano le Mura, e Travi con acqua di Calcina viva, ed indi scoperto buona parte o tutto il Tetto, si lasciava così per 30 giorni, acciò l'aria, o la Pioggia depurassero internamente ogni sua contaminazione prima di riabitarla.

In sequela poi delle espurgo, colle possibili diligenze / praticato a tutte le Case infette, ed alli rispettivi Arnesi, Casse, e Bottame, si rovesciarono le muraglie, unitamente alla terra degl' Orti loro più prossimi, e si diedero alle fiamme le Paglie, col Fieno ammu-
chiato nel contorno, e vicinanza d'ogni Casa espurgata, da che sortì l'Erba da nutrire gl'Animali ad esse Case spettanti. Ciò fù eseguito per accertarsi dei Criminosi, e fatalissimi ripostigli, se mai fatto ne avessero di qualche roba contaminata, onde con tali esperimenti rendere sempre più cautelata la materia di Salute, in circostanze tanto moleste, quanto che da ogni piccola trascuratezza, poteva novamente rissorgere nei Borghi l'incendio sofferto, e cagionare la totale rovina di quella Popolazione. 187

Terminata nei modi riferiti l'opera importantissima del generale espurgo delle Case, e risultando per effetto della Divina Misericordia, la sospensione dell'attacco Contagioso, sino dagl' ultimi di Febraro nei Borghi minori, e dal primo di Aprile nel Borgo Grande, o sia di S^a Croce, si fecero passare le rispettive Famiglie a riabitarle, dopo essere state 80 giorni (42) rinchiusse nei Lazza-
retti senza disgrazia del malore, per cui vi furono poste / in risserva. Poscia si obbligarono, ad oggetto di sperimentare la buona
qualità dell' espurgo, di stare altri 15 giorni nella risserva delle proprie Case, innanzicchè permetterle di comunicare con l'altre Case rimaste sempre in buona Salute. 187

Il Principio del felice riduzione dell' afflittè Famiglie nelle rispettive Case fù ritardato per oggetti di buona cautela, sino ai 23 d'Aprile, indi si proseguì ad effettuarlo coi rapporti del tempo, che successivamente corrispondeva all'innalterabile risserva degl'80 giorni, e sempre con esito favorito dalla protezione della Beata Vergine, sino all'intero finimento, senza che gl'accidenti posteriori dei Beccamorti, ed altre Persone di quella natura, portassero male conseguenze alla Salute ristabilita nella Popolazione dei Borghi.

Di questi accidenti successi, dopo il tempo indicato ai Beccamorti, ed altre Persone seggreate dalla mescolanza dei Borghi-giani, ne dirò fra poco alcune particolarità coerenti all'estesa di

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questa Relazione, ma pertanto convien dire in succinto quel pocco, che solo riguarda il termine dell'assunto preso intorno alla liberazione dei Borghi, qvalli meritano gl'effetti della Comiserazione del Principe, e qvelli particolarmente dell' Eccellentissimo nostro Proconsole, che in un tempo ebbe a Salvarli dai due voraci Mostri della Peste, colla Fame, riconducendovi la Salute, coll'abbondanza insieme.

Cessato dunque ogni funesto attacco alla popolazione dei Borghi, e ricondotte come dissi dai Lazzaretti tutte le Famiglie ad abitare le rispettive Case; ne più restando materia, che intorbidar potesse la tranquillità di una Salute universalmente ristabilita, si diede ai 10 di Giugno la libertà della comunicazione fra li Borghi; indi si levò il freno della Linea prossima, formandone un' altra più estesa, e distante da Doimovaz, (43) sino alle Villa Stobrèz, acciò potessero raccorre le biade loro, ed attendere agl'Ufficj rusticalli nella pertinenza rispettiva, senza comunicare coi Villici del Territorio.

Compiuta così felicemente l'opera d'ogni Espurgo, e fatti più che mai certi dell'accuratezza degl'esperimenti, che nei Borghi per somma grazia del Salvator Divino, era già estinta l'orrida fiamma della Peste Infernale, si fecero anche incenerire le Schiavine, Capotti, e Paglioni che servito avevano ad uso degl'Infetti nell'Ospedale, onde rimuovere dall'idea ogni sospetto, e cautelare, per ogni verso il fatto della Comune Salute .

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Cessata colla serenità delle cose, la caggione di più ritenere / il Zicavo nei Borghi, fu richiamato all'obbedienza della Suprema Carica Generalizia, unitamente al Benemerito Capitano SMACCHIA suo Assistente; qvalli con animo ripieno dell'onorata compiacenza, che loro apportavano gl'applausi della Popolazione, non che di quella del Pubblico gradimento, per il buon servizio prestato nella fatal' urgenza del Contagioso Morbo, si trasferirono ai 23 di Giugno nei Lazzaretti di Spalato, e vi scontarono li 40 giorni dell'ordinaria risserva.

Il dolce riflesso di aver superato un cimento così periglioso, e di aver possibilmente contribuito al beneficio di tanta Gente posta in angustie dal più orrido dei mali Terreni, era per loro un Conforto di compensazione alle faticose diligenze praticate in sì lunga Battaglia, e sempre di Fronte alla Morte, che ad ogni passo insidiava loro la Vita : Mà il Fervoroso Zelo, da cui furono

sempre animati, per corrispondere all'oggetto dell'incarico addossato, prevalse in ogni tempo al Terrore, che seco portava la Strage delle Persone attaccate da sì fiero Nemico, qual è la Peste.

Questo spietato Mostro, diede la Morte nella violenza del suo furore a tutti quelli, che furono colpiti dall'infezione del di lui velenoso attacco senza dar tempo ai suffraggi dell'Arte Medica, ovvero dar luogo alla virtù dei Medicamenti, che riuscirono sempre inutili alla Fierrezza del Male; pure da che si posero le necessarie difese alla Malignità delle sue conquiste, col mezzo delle Segregazioni personali, e di tutto quello, che le serviva di nutrimento, divenne meno crudele nei suoi mortiferi effetti, tantochè, se nel principio lasciava in Vita uno appena dei 100 feriti, nel suo finimento, non era poi sollecito alla comunicazione come prima, e dei feriti ne guarivano più di due terzi.

Quattrocento sessantotto furono gl'estinti dal Contagioso Morbo nei 4 Borghi compreso 25 trà Soldati, Beccamorti e Serventi agli Spedali, ma prima che ne guarisse alcuno, erano già morte più de 200 Persone. Poscia rallentando la malignità del Veleno pestilenziale, incominciarono a maturarsi li Bubboni, ed anche li Carboni, che non erano della qualità più maligna, cosicchè di 518 Persone attaccate nel corso della Contaggiosa Epidemia ne guarirono 50, e furono 20 Vomini, e 30 Donne.

Alcuni di questi Morivano in poche Ore, o in un giorno di male; mà tutti morivano vomitando Vermi di Color diverso, e soffrendo atrocissimi dolori di Capo, e nelle Viscere.

Moltissimi poi morivano nel 2º e 3º giorno dell'attacco. / chi con Pettechie di grandezze diverse, e colorito livido Pavonazzo, e chi con Bubboni, e Carboni, che la Natura tentava di mandare alla Cute, in Solievo del Ammalato, ma nella premura ch'essa dimostrava sollecitando i suoi Soccorsi, vi appariva la mancanza dell' necessario vigore per vincere il male.

Se talvolta si sforzava di resistere più giorni alla Morte con apparenza di riportar la Vittoria, si vedevano poi nella dolce lusinga del beneficio, rapir lo Spirito all'improvviso, conservando per altro come vivente l'occhio, e l'effigie al naturale; ma tutti però tramandavano dalla bocca una quantità di Schiuma viscida, e molto bianca; e restavano agl'uni flessibili le Membra, ed agl'altri estesi, e duri.

Di tutti quelli ai quali la Natura non diede altro soccorso, che quello dell'espulsione delle Pettecchie, ovvero dei Bubboni, e Carboni, che non giunsero a marcire, sopravvissero due sole Donne, con un Bastaggio, a cui li Bubboni espulsi sotto l'Ascella, ed Anguinaglia dritta svanirono, dopo 20 giorni del di loro appartamento, ma questo fù assistito a tempo dal Dr. SAJANO coi medicinali deviativi la malignità del velenose concorso. Quelli poi ai quali la natura ebbe / forza di far marcire li Bubboni, e massime quando erano sotto l'anguinaglia, dove sembrava poter meglio facilitare il beneficio, restarono tutti vincitori della Morte.

Vno dei contrassegni più Mortali dell'Infermo erano le Pettecchie, con certi Carboni, che non elevavano alla Cute, se non una Vesicichetta, come la scottatura d'Acqua bolente, ripiena d'un Sero Gialletto, e torbido, ma sotto vi conteneva una Crosta negra, che in breve si dilatava con apparenza cangrenosa, ne miglior lusinga davano li Bubboni espulsi sotto le jugulari, ed ascelle, poicchè di tante Persone, a quali apparvero negl'espressi luoghi, a due soli Bastaggi si marcirono, e produssero il gvarimento, ed anche questo successe, quando la Contaggiosa influenza era verso il suo fine.

Al primo attacco del Male, che ben presto dilatava le qualità sue crudeli, opprimendo l'Infermo con dolori acutissimi di Testa, e confusione di mente, si vedeva in un tempo l'abbattimento delle forze, con tutte l'altre Marche indicate nella istruzione, che dissi delle Visite, mà nonostante tutto questo, si sforzava un ciascheduno di resistere all'esperimento, per non apparire incorso con reità nella deplorabile disgrazia, e / per dire tutt'altro, che la vera causa della rispettiva infezione.

Quale fosse la costernazione, e lo smarimento di quella misera Gente, a cui si dava il tetro annunzio d'essere Colpita dal Contagioso flagello, sarà facile tal volta di poterselo immaginare, mà non di Saperlo dire; poichè atterriva tanto quelli che restavano involti nella disgrazia del fatto, quanto gl'altri, che nell'evvidenza del pericolo vivevano in timore di doverla incontrare.

Essendo così tutti spaventati, ed insieme attenti al solo interesse della propria Salvezza, null'altro curando un ciascheduno, che presservar se stesso; si videro i Padri, a mancare della natural tenerezza ai bisogni dei Figli oppressi; e le Madri vinte dall'orridezza di sì brutta morte, staccarsi dal Senno i Pargoletti, e ab-

bandonarli semmivivi in Cuna; poi nella dolce lusinga di campar la Vita, correre come stupide in altro luogo a morire.

Di qval Carrattere fosse mai la Peste, che nei Borghi di Spalato ha causato tanto lugubri accidenti, ne lascio l'incarico di dirlo alli Scientifici Professori della Medicina, giacchè loro san darle molti Agnomi; ed a me basta il poter fare la narrazione delle cose più distinte, che relativamente alla stessa vi successero, e che fedelmente qvi si rapportano / da quello che fu presente, 22^r sino al finimento delle riferite disgrazie.

Se dovessi prestar fede ai costituiti, che tanti miseri dei Borghi esposero, perchè si credesse senza loro colpa l'infezione, direi, che la Peste riferita era di quella natura, che corrompeva la Salute col mezzo solo degl'effluvi, negando essi di aver mai toccato robba, o Persone contaminate, mà l'esperimento di chi qvasi giornalmente fu negli Spedali, e in altri luoghi appestati, senza contrarre la disgrazia del Malore, quantunqve non avesse la difesa di certi presservativi di grand' odore; prova, che gl'effluvj senza contato di Robba, o di Persone infette, non caggionavano la corruzione della Salute.

Ad ogni modo dico, che si devono fuggire gl'effluvj contaminati nell'ambiente dei Letti oue sieno alla rifusa molti ammalati, quando massime vi manchi l'uso frequente dei Profumi correttivi, ed anche la libertà dell'Aria esteriore, ovvero quando la Persona, che frequenta il periglioso luogo, sia di Cuore apprensivo, e Malinconico, ed anche di temperamento mal disposto, e gracile, tuttavolta nella riferita Contaggione, non si vide infettare alcuno, se prima non aveva toccato in qualche modo contraente la Robba, o le Persone Contaggiose. /

Tutti li Beccamorti, Bastaggi Sporchi, e Serventi degli Spedali, 22^v contrassero il Malore, chi presto, e chi più tardi nel frequente maneggio, che facevano della Robba, e Persone infettate, a risserva però d'un certo Francese di cognome PADOVEN (44), qvale tagliava li Bubboni, e medicava nell'Ospedale, ove fu sempre senza la menoma difesa presservativa; pure fu il solo rispettato dal Contaggioso attacco, mà gl'altri niuno eccettuato s'infettarono tutti, da che si fecero arditi, e confidenti nel prendere a mani nude le Cose appestate.

Tre particolarmente si credevano invulnerabili, dopo molti esperimenti fatti, toccando senza risserva ogni cosa infetta, mà nel fine dell'opera contrassero tutti tre la Peste, colla morte del più Benemerito per li Serviggi Prestati.

23^r Questo appunto, che dissi Benemerito più degl'altri, e che dovette soccombere alla fatalità del suo Destino era un Caporale della Compagnia Capitano SACCHI, col nome di GIUSEPPE FLOSBERGH (45); qvale ritrovandosi a caso fuori della Città di Spalato, qvando successe la manifestazione della Peste nei Borghi, si offerse volontario al servizio dell'Ospedale Maggiore degl'Infetti, colla qvalità d'Infermiere, Ivi senza risserva, ne diffese, visse illeso per il corso di 4 Mesi, restando giorno, e notte nel mezzo degl'Appestati, e medicando / con vera Carità Cristiana li Bubbboni, e Carboni a 192 Persone, che vi morirono prima di lui, oltre qvelli di altri 48 che ottennero il gvarimento, ma dopo tutto questo, e qvando era già voto l'Ospedale, si vide attaccato il misero, e vinto dalla Peste, con l'espulsione di molti Carboni di qvalità Cangrenosa, qvali lo condussero a morte in 14 giorni di Male, con sorpresa, e sommo rincrescimento di tutti.

Il secondo dei tre accennati, era un giovine bastaggio, che aveva maneggiato in confidenza la robba, e le Persone infette per molto tempo, ed aveva dormito una Notte con tre altri bastaggi, che già erano coll'attualità dell'Infezione oltre d'essere caduto sotto un'altro appestato nel condurlo all'Ospedale; pure alla fine contrasse il malore, come disse lui, per aver toccato il Sangve caldo d'un infetto Bastaggio, che si fece passer per l'Armi, avendo commesso grave mancamento su la materia di Sanità.

23^v Il Terzo poi era un Vomo di 50 anni, simile al Caporale nell'uffizio d'Infermiere, qvale serviva senza timore d'infettarsi, per aver altra volta sofferto l'attacco della Peste, qvando fu nei Borghi l'anno 1731, mà nonostante la fiducia di non doverla più contrarre, sia per la caggione addotta, che per il lungo esperimento fatto, nell'Ospedale dovette ad ogni modo restare attaccato nella / Medicatura, ed assistenza prestata al Caporale riferito. Tuttavolta egli gvari presto dall'espulso Bubbone, come successe all'altro giovinotto bastaggio sopradetto ; e con qvesti accidenti, si estinse del tutto il Contagioso Morbo.

Voglio dunqve concludere dagl'accidenti esposti, che la frequente attrazione degl'effluj contaminati, coabitando nell'Ospedale

infetto, averanno indebolito la forza repulsante gl'attacchi degl'aliti Velenosi di tanti Appestati, che furono nell'Ospedale accennato; cosichè vinta in fine la resistenza della difesa nella Battaglia dei replicati toccamenti, averanno in ogni occasione di contatto, intruso un qualche atomo Velenoso nel Sangve. Divvenuti questi atomi numerosi al grado di riportar la Vittoria sopra la resistenza d'ogni complessione, posta in cimento, ne succede poi, che anche le Persone della più robusta Salute, quando tocchino, e ritocchino la materia Contaggiosa, che serve a disporle, ne farano certamente l'acqvisto, come appunto si è veduto coll'esperienza dei Beccamorti.

Questo flagello, che con tanta frequenza invade la Dalmazia per la sua Confinazione colla Bossina, ove la Peste tiene per così dire il suo Domicilio, richiede le più maturate riflessioni del Principe, onde all'avvenire si tenga lontano il malore / dal Veneto Paese, come sembrami, che con sarebbe gran cosa difficile di poter fare, quando si volesse gradire quanto frà poco sarò per dimostrare.

24^r

Se ciò non meritasse il Pubblico gradimento per quelle alte ragioni, che senza intenderle conviene di venerare, vorrei dire, che almeno si tengano in pronto dei Borghi di Spalato li necessarij provvedimenti all'importanza dell'oggetto, fabbricando due Lazzeretti Campestri, ed un grand'Ospedale ad uso degl'Infetti; mentre volendo continuare il Commercio della Caravana, e l'Armo del Confine col metodo praticato sino ad ora, converrà di attendervi la Peste tutte le volte, che la sentiranno allignata nella Turchia Confinante.

Già si sà, che le Segregazioni fatte in tempo, presservano le Famiglie dalla Contaminazione, che caggiona la mescolanza, e facilitano il gvarimento delle Persone attaccate dal Contaggio; poichè se Tizzio in esempio sia condotto all'Ospedale con 10 gradi d'Infezione, egli potrà gvarire, coll'assistenza della Medicina, quando sia posto in un Letto sano, ed in luogo separato, e difeso dagl'Aliti corrotti d'altro Infetto; Mà egli dovrà poi soccombere, qual ora si ponga in / vicinanza, e comunicazione con altra Persona, che abbia maggior intacco del male stesso.

24^v

Così appunto succedeva negli Spedali dei Borghi di Spalato, dove non potendosi fare le necessarie separazioni conveniva che tutti gl'Ammalati risentissero l'aumento della corruzione cagionata

dall'ambiente indiviso degl'Infetti, oltre quello, che gli derivava dell'essere una qualche volta obbligato per mancamento dei mezzi ad usare della robba, che servito aveva di Letto a chi era poco innanzi morto dal Contaggio ; sia in difetto di poterla espurgare colla relazione del bisogno, ovvero di poterne provvedere in tempo, e quanto ne richiedeva la grand urgenza dei tanti che furono condotti all'Ospedale durante il furore del Morbo.

25^r Converrebbe dunque in prevenzione del bisogno, che saranno per avere li Borghi di Spalato, sempre che non venga sospeso il traffico della Carravana, quando esiste il Contaggio nella Bossina, un Ospedale fabbricato a San Steffano, come luogo separato, ed a competente distanza dalle Abbitazioni, poi farlo tanto grande, che vi potessero capire 100 Ammalati nelle Rispettive Stanzette regolamente divise, e ben difese, acciò la corruzione degl'aliti dell'uno / non potessero inferire aumento di Male all'altro. Così pure dovesse contennere in luoghi opportuni li Serventi necessarj, li Beccamorti, e tutte l'altre Persone da impiegare nei diversi ufficj della materia di Salute.

Questa sarebbe una spesa di molto riflesso, mà però necessaria da farsi, unindovi ancora li provvedimenti, che devono servire a frenare in tempo il furore del Contagioso Morbo, al caso di nuova insorgenza, e devviare così gravi danni delle funestissime sue conseguenze, opprimendolo a prima vista, e nel suo nascere, mentre l'esperienza ne documenta, che togliendo immediate la mescolanza della Gente, col mezzo delle segregazioni, si taglia la radice del Male, prima che si dilatti, e si uccide, come suol dirsi, l'orrido mostro in Cuna.

25^r Anche nelle Ville della Provincia, ove per disgrazia loro insorga la Peste a qualche Famiglia si dovrebbe immediate ordinare alle Ville Sane l'errezione d'un Ospedale alla Rustica, mà diviso in tante Cappanette ad uso d'una Persona per ciascheduna ; e farne quante Bastar potessero alle Persone infette della tal Villa intacata dal Malore; così pure si dovrebbe fare un Lazzaretto composto di tante Cappanne, quante fossero le Famiglie della Villa; / mà che fossero relative al numero delle Persone da porre in ciascheduna, e situarlo dove meglio convenisse, colle necessarie separazioni, ed in figura di un Qvadrilungo circondato da Steccati di Palli, o di Cavalli di Frisa, e custodito da sufficiente numero

di regolata, e ben diretta Milizia, sino al termine di quel periodo, che statuiscono le leggi di Sanità.

Poscia converrebbe spurgare la robba loro coll'immersione, o bollitura, ardere le ordinarie loro Cappane fatte con muraglia di Pietra sconnessa, e con il tetto di Paglia, ed espurgare nei modi più confacenti alla gelosia della materia, le Case fabbricate nel modo meno Rustico, poiche così facendo si terminerebbe con brevità di tempo tutto l'affare, si salverebbero tante Persone, che periscono, stando attaccati all'ordinario metodo di tenere in particolar risserva la sola Casa infetta. E quello poichè maggiormente importa, si toglierebbe l'arbitrio delle clandestine comunicazioni tra Villici, qvali non possono a meno, che diffondere il Contaggio per tutta la Provincia, ed oltre ancora.

La proposizione sembrarà talvolta un pocco gravosa per l'universale d'una Villa, che si obbliga di soggiacere / all'Espurgo, come se tutte le Famiglie fossero incorse nella stessa disgrazia d'infezione; mà riflettendo, come lo merita la Gelosia dell'argomento, l'utilità dell'opera, ed il bisogno di così praticare, la Proposizione non sarà gravosa, mà bensi di riflessibile giovamento, trattandosi di estinguere alla più lunga in due mesi quel fuoco, che preso combattere a parte, a parte dura gran tempo, e sempre col pericolo d'incendiare la Villa tutta, ed anche il Territorio più vicino.

265

Le Cappanne, o siano Cucchie, come volgarmente le dicono, sono facili ad essere rifabbricate, stante l'abbondanza delle Pietre, Paglia, e Legname, che a tale uso si ritrovano in ogni Territorio, e stantecchè la fattura non costa dannaro; mentre in tale uffizio sono Macstri per se stessi, e si prestano a vicenda l'opera, che occorre a simili edificj, massime quando si tratta d'una disgrazia, qual è la Peste.

In ogni caso di maggior difficoltà nell'apprestamento del Materiale, si potrebbero costringere le Ville prossime, ad amministrarlo con li rigvardi dovuti alla materia di Salute; acciò le Famiglie dell'afflitta Villa, risentissero / con meno dolore le angustie della risserva, e vedessero l'incendio delle povere loro Cappanne con pocco rincrescimento.

267

Qvì non parlo delle attenzioni necessarie all'espurgo della Robba, ovvero delle diligenze da praticare nei contorni d'ogni Cappanna, onde non vi resti materia impura nei fatali Nascondigli, ovvero esposta, poichè ne ho già detto abbastanza in altro luogo. Lascio

egualmente di fare istruzione, sopra le avvertenze da praticare, consegnando ad altri Villici Sani, tutto il Bestiame dei Villici destinati alla risserva nel Lazaretto; mentre ogni Persona, incaricata della Sopraintendenza nel proposito, saprà farlo sgvazzare prima della consegna; ed io sapendo d'essermi anche troppo diffuso colla presente narrazione, farò passaggio da questa al punto interessante della difesa, che contiene il Progetto seguente.

FINE.

27*

PROGRETTO.

Passando poi dall'argomento di trattar l'estinzione della Peste nelle Ville, a quello d'impedire il suo fatale ingresso nella Provincia, e particolarmente nei Borghi di Spalato; dirò, che mettendo ad effetto la proposizione, qvale mi fò lecito di esporre, il Contaggio della Turchia, non sorpasserà certamente i limiti del nostro Confine; semprecchè vengano adempiute tutte le condizioni, che richiede l'importanza dell'assunto, e quelle, che formano l'essenziale generico della mia proposizione.

27*

Primieramente dunque converrebbe di allontanare la Causa principale dell'Infezzione, provvedendo un miglior mezzo di Cautella nel Commercio della Carravanna perveniente dalla Bossina, e questo sarebbe fabbricando un Lazzaretto regolato, ed ampio a Sufficienza, per contennere la Mercanzia, la Gente di Servizio, è la Soldatesca necessaria per farlo rispettera; mà però da fabbricarlo sopra l'Isoletta, che il Fiume Zettina / circonda colle sue acque, dove appunto una volta era il Ponte detto di Hâm (46).

Questo luogo, che'è distante 4 Miglia da Sign, e 6 da Bilibrih, primo appostamento del nostro Confine, è un luogo proprio singolarmente agl'Espurghi per il comodo dell'acqua, ed a cautellare la gelosia della materia, sia per il vantaggio del sito Isolato, e rimoto da ogni abitazione, che per la facilità di farvi ricapitare le Mercanzie, senza pericolo di alcun Contrabando per la Strada; quando vi siano le dovute scorte della Truppa regolata, e Nazionale, come la più rispettata dai Turchi, sempre altieri, e sempre resistenti all'obbedienza delle Leggi nostre.

Li Mercanti però, e quelli, che si lusingano di proffittare sopra la disgrazia degl'accidenti Contaggiosi diranno, che il proposto

Lazaretto, sarebbe d'aggravio particolare ai Negozianti, riguardo all'alterazione delle Spese del trasporto, e che sarebbe ancora di sommo impegno riguardo a quei Turchi, quali avessero pretesti, o motivo di andare a Spalato, per farvi le provviste di quelle Robbe, che non saprebbero ritrovare / nel rispettivo loro Paese, mà si rissolve l'obbietto dicendo, che l'aggravio della Spesa dei trasporti, si potrà compensare nei Contratti reciprochi, ed il supposto impegno co' Turchi, riguardo alle provviste da fare a Spalato, sarà immediate rimmoso, quando dai nostri Mercanti, verranno provvedute le cose occorrenti al consueto bisogno dei Turchi, e preparate all'oggetto stesso nel recinto del nuovo Lazaretto. 287

Diranno ancora, che per alienare ogni pericolo della gelosa materia, ed ovviarre coi disturbi, anche il dispendio della Fabbrica, bastar potrebbe l'esecuzione dei metodi regolarmente stabiliti dal sublime intendimento del fu Ecc.mo Signor Procurator SIMONE CONTARINI (47) di felice ricordanza, per condurre le Carravanne colle dovute risserve dall'Appostamento di Bilibrigh, sino ai Lazzaretti di Spalato.

Il fatto veramente non si potrebbe negare, quando si osservassero, ed osservare si potessero in ogni tempo le Salutari prescrizioni, con somma Provvidenza rilasciate dal Preallegato Luminosissimo Soggetto sulla materia di Salute; onde alla maturità, e Saggezza di sue premesse, vi dovessero poi corrispondere con esito felice le necessarie Conseguenze.

Dirò ancora in segvela di tale argomento, che l'effetto sarebbe sempre rellativo all'importanza della Salute, qvalor / sempre venissero scortate le Carravane in tutto il Viaggio, senza lesione di quei tanti ordini, che vi sono al proposito; e dirò anche, che vicpiù si otterrebbe l'effetto desiderato, qualora vi fosse pronto il dovuto Castigo a tutte le Contrafazioni della gelosa materia, trattando con egval esempio di rigore li funesti prodotti dalla negligenza, quanto quelli della reità maliziosa; poicchè i mali effetti dell'una, sono sempre di pari dano, a quelli dell'altra nel grave affare di Sanità. 287

Mà il fatto sta poi, che non essendo in ogni tempo presente l'oggetto infausto del Contagioso Malore, si trascura in confidenza l'esecuzione degl'ordini più Salutari, e si discende facilmente al perdono dei falli altrui; ovvero mancando, come spesso accade la Milizia, che richiede la Gelosia dell'impegno dalla scorta,

occorre di sostituirvi alcuni Panduri (48), poco meno che disarmati, qvali nell'uffizzio di accompagnare la Carravanna, vengono corrotti dai Compratori di Contrabando, ed anche vilipesi e percossi dai Turchi, che numerosi ed armati seggono scorrettamente la Mercanzia loro, sino al consueto ricapito dei Lazaretti.

29^r Dirò ancora di più, che l'obbligo di ubbidire alle Sovrane Leggi del Principe, riguarda così bene qvelli, che nacqvero / dipendenti, come qvelli, che si vi trovano in officio di comando subordinato alle Leggi medesime, mà nulladimeno il zelo dell'osservanza è sempre ristretto in pochissimi; qvali poi non bastano a frenare col di loro bvon esempio il mal talento dei Contrafattori, ne tampoco ad impedire, che gl'ordini dirretti alla presservazione della Salute, non sieno a lungo tratto adulterati per un lucro egualmente infelice ne'suoi effetti, che nella sua reità.

Convien anche dire in oltre, che la naturale avidità di questa indisciplinata Popolazione, la scorrettezza, ed alterigia indomabile de' Turchi, la mala qualità, e poco numero della nostra Soldatesca, che non csigge rispetto, ne può farsi valere per altri rigvardi, unito alli moltissimi altri abusi, che porrei additare, saranno al certo condizioni sempre pocco confacenti, per non dirle appertamente contrarie alla presservazione di questa Provincia dalla Peste; qvalora si continui a volere il transito della Carravana, e sue Mercanzie infette sino ai Lazaretti di Spalato.

29^r Dunque concludo, e dico, che nella difficoltà in cui saremo di rimuovere affatto le accennate discrepanze con tutte le altre, che insieme tendono a sovvertire li bvoni effetti delle più regolate disposizioni; e volendo in ogni modo la maturità, ed intelligenza Sublime di chi presciende / nella Dominante al gelosissimo incarico della Salute, presservare illesa dal Contagioso Malore questa Provincia. Non vi sarà certamente rimedio più efficace da porre alla difesa del pericolo dimostrato, se non lo stabilimento del nuovo Lazaretto, che servir deve di riparo alle successive disgrazie, per conto della Carravanna.

Qvivi facendo riccapitare all'ordinario espurgo tutte la Mercanzie soggette al Contagioso intacco, sotto la direzione d'un Priore coi Subbalterni occorrenti all'ufficio Salutare, non succederebbero all'avvenire li deplorabili effetti più volte caggionati dalla scorretta baldanza dei Turchi Carravanisti; qvali passando d'intelligenza con qvelli Sudditi, che stano sull'incette di Contrafazione,

introducono la Peste col mezzo delle Schiavine, o Lane contaminate, come appunto successe l'anno decorso nei Borghi di Spalato; e come alla giornata succede nelle Ville Confinanti colla Turchia, che ad onta del Publico Sovurano divvietto, e della loro rovina, non si sanno astenere dalla reità del Contrabando.

Terminato poi che fosse l'espurgo d'ogni Mercanzia nel proposto Lazaretto, si potrebbero diffondere ovunque lo richiedesse il Commercio della Provincia / ovvero trasferirle come più giovasse nei Lazzaretti di Spalato; qvali servirebbero allora per le sole Contumazie della Gente, o Merci che vi pervenissero da Contrade Marine, e servirebbero ancora per Deposito di quanto si volesse mandare a Venezia, ed altri luoghi accordati alla corrispondenza Mercantile, come in Ancona, ed a Trieste, dove al presente si fa riccapitare molta Cera, e quantità di Pellame conciato nella Turchia.

30^r

Qvalora mai fosse gradito dalla Sapienza dell'Eccellentissimo Magistrato un tale Progetto, senza dare ascolto a quella difficoltà, che li nostri Trafficanti colla Turchia gli facessero, come gente sempre intenta di far preporre all'universale beneficio il proprio interesse; in quel caso dico, converrebbe proibire sotto le più gravi penne ai Negozianti della Provincia, di non introdurre per altro luogo le Mercanzie sospette, se non per il passaggio di Billibrigh; qvale dovrebbe tenere pressidiato in ogni tempo, colla forza di 60 Soldati a piede coperti da un Capitano, ed un Alfiere, due Sargenti, e quattro Caporali, oltre venti Soldati a Cavallo, diretti da un Subalterno, con un Basso Ufficiale della specie medesima. /

Regolata che fosse una volta la condotta della Carravanna nel modo esposto, e reso cautellato il nostro Commercio dai mali Contagiosi della Mercanzia che ci porta, converrebbe con impegno pari a questo, dare tutta la mano all'importanza della disposizione attiva per l'esterna difesa; qvale appunto è quella, da cui all'avvenire aurà da dipendere l'intero presservamento della Provincia.

30^r

Questa disposizione, che riguarda un oggetto di tanto interesse, quanto si può considerare il valore dalla Salute di molti Popoli, esposti al pericolo di essere contaminati ogni qvalvolta, si dichiara la Peste nella Bossina, richiede al caso di sospetto avverato un'Armo innalterrabile di Milizia pagata sopra tutto il Confine; mà che sia della forza necessaria, per custodire a tutta difesa la Linea

di 180, e più miglia, qvale divide la Dalmazia dall'Ottomano Stato, e sia parimenti, con tutte qvelle condizioni di suffraggio, che vagliano a rendere gradito il peso dei patimenti, a chi serve; non che a produrre con esattezza pari al dovere, l'adempimento del Pubblico Comando nella gelosa materia.

31^r Per fare dunqve un Armo corrispondente alla grand'estesa da custodire, ci vorrebbero per il meno che sia 50 Compagnie Reggimentate; ma Nazzionali, e di 100 Soldati l'una, / coperte dei rispettivi Officiali, oltre dve Sargenti, e cinque Capitani per ciascheduna; mentre il tratto della Linea, che cresce al di sopra dei 180 miglia indicati, ricchiede un'ordine competente di Caselli A mati, ed erretti a vista prossima l'uno dall'altro; cosicchè fra loro, non vi sia maggior distanza di 250 passi, ch'è pure una troppo lunga distanza, perche le Sentinelle possano vedere tutto ciò, che tentasse d'uscire, o d'entrare clandestinamente nella nostra linea, e massime dove s'interpongono Vallette boscosc, o ripide prominenze alle rispettive Visvali.

Computando in tale modo il numero dei Caselli occorrenti all'estesa riferita, che forma la Nostra divisoria col Turco, prendendola dal triplice Confine, sino all'estremo della Narenta, li Caselli da doversi armare con la forza rellativa al differente impegno delle situazioni, ascenderebbero a 700., e 20., e l'Armo proposto di 5000. Fanti non corrisponderebbe al bisogno della custodia voluta; mà comechè nel totale della riferita estesa, vi sono alcuni Ristagni d'acqva profonda, e molti tratti di dirrupati Scaglioni che vietano il transito ad ogni Pedone; così la Linea da pressidiare, si può restringere al solo Spazzio di 150 Miglia circa, e in conseguenza ridursi all'Armo sufficiente di 600 Caselli. /

31^r Qvesti 600 Caselli ripartiti a 4 per ciaschedun Miglio, nella total estesa dei 150 Miglia, che dissi del Confine, capace di dar transito ai Pedoni, verranno armati colla distinzione della forza, che può meritare l'impegno dei passaggi più frequentati, e massime dove sarranno Stangate o Lazaretti campestri, per accogliere qvei Sudditi Montanari, ai qvali venisse accordato di scontrarvi la qvarantena, quando prima della segregazione si fossero ritrovati nella Turchia, e poi bramassero di ritornare colle Famiglie loro nello Stato Veneto.

L'appostamento del maggior impegno di tutta la Linea, si deve computare quello di Bilibrigh; e però essendo esso pure

fra li Posti del Cordone da Pressidiare col totale della Forza, si armarà con distinzione da tutti gl'altri Appostamenti e col numero della Gente, che già dissi pocco prima.

Restandoci poi 34 Capitani del complesso delle 50 Compagnie si disporranno nei luoghi più importanti; assegnando nel pieno del mio Riparto 24 Soldati, ed un Caporale per ciascheduno; acciò vi sia da togliere 4 Soldati a qvelli, che saranno destinati ai passaggi della minor frequenza per aumentare sino a 30, ed anche 36 Soldati alcuni Posti, qvalli sono del Maggior concorso, / 32^e e con le Stangate sopra le Strade maestre, che ci derivano dalla Turchia.

Si disporranno ancora li 49. Alfieri, che abbiamo agl'appostamenti delle Strade dell'ordinario concorso, e ciò con 16 Soldati, ed un Caporale per ciascheduno; ed ai Posti meno frequentati dei primi, si destinarono li Novant'otto Sargenti, che ci restano, e se gli darà 10 Soldati per uno. Indi si disporranno li 163 Caporali che si sono avanzati dalle precedenti disposizioni, ponendoli con 5 Soldati per uno in tanti Caselli; poi si terminerà l'Armo di tutto il Cordone con altri 255 Caselli coperti da tanti vice Caporali estratti dal pieno dei 5000 Soldati, con 5 Soldati d'Armo per ciascheduno, alla risserva però di 15 Caselli. che il totale della Fanteria proposta, ci accorda la Forza di poterli armare con 6 Soldati per uno.

Con la serie degl'accennati Riparti vedremo, che l'Armo della nostra Linea, non eccede il puro bisogno alla custodia di tanta estesa, come ben apparisce da qvesta disposizione a miglior chiarezza replicata, onde rissulti la forza divisa nel Dettaglio delle porzioni, e qveste ancora dimostrino nelle qvantità specifiche il pieno della Forza totale. Così dunqve disponendo 866 Soldati / in 35 Apposta- 32^e menti Comandati da tanti Capitani, ed 784 Fanti divisi a 49 altri Appostamenti diretti da tanti Alfieri, non che 980 Soldati ripartiti nell'Armo di 98 Caselli, coperti da egval numero di Sargenti, oltre la Forza di 2105 Soldati, messi alla custodia di 418 Caselli, coperti da pari numero di Caporali, e Vice Caporali. Noi averemo coll'Appostamento di Billibrigh espresso il numero di 5000 Fanti, compreso li 255 Vice Caporali nell Armo di 600 Caselli, necessari per la Salute di qvesta Provincia.

L'estesa della Linea è della qvantità di miglia, che già dissi, e posso accertarlo, senza timore di mentire; poichè l'ho trascorsa

da un Capo all'altro, in vista di riconoscere le Colle dei Monti, le Sboccature dei Passaggi, ed ogn'altro sito, dove si potesse resistere vantaggiosamente al caso mai, che insorgesse qualche rottura, o Gverra coi Turchi : Onde concessa che sia la verità del fatto, e che resti comprovata nel suo essere l'estesa di 150 Miglia, che la linea da Custodire abbraccia nella divisoria dell'Ottomano Confine, non si può negare, che per metterla in difesa sufficiente, contro il più nocivo dei mali, qual' è la Peste, non vi sia necessario lo stabilimento di 600 Caselli; e in conseguenza necessaria egualmente la proposta Milizia per Armarli.

33^r Qualora si fosse persuaso della quantità dei Posti armati / come giova credere, ma che vi fosse qualche cosa da dire sopra il numero dei Soldati, che ne formano l'armo, riguardandolo eccedente nel suo Specifico. Io rissolvo l'obbietto dicendo, che nei Caselli minori, ove sono 5 Soldati, dovrebbero essere 6 almeno; acciò il peso delle Sentinelle nei Posti fissi non le divenga intollerabile, come riesce, dove sono 4 soli Fanti, o perchè fuggendo un qualcheduno, ed anche ammalandosi, non manchi la vigilanza, che richiede la gelosia della materia; come succede quando nei Caselli armati da 4 ne manchi uno.

Se poi vi fosse da dire sopra la forza degli'Appostamenti coperti dai Capitani, Alfieri, e Sargenti, la mia risposta si deve prendere dall'esame dei pesi rispettivi; mentre un ciascheduno, tiene l'obbligo d'una Sentinella continua, come li Caselli minori, oltre quello di dover spedire le Ronde colla forza di Pattuglia, onde osservare la vigilanza dei Posti Subordinati, e tessere, particolarmente la notte, gl'intervalli delle Sentinelle, per fermare in ogni modo chi volesse uscire, ovvero entrare clandestinamente nella Linea. Gl'appostamenti poi della maggior forza, in aggiunta dei pesi accennati, tengono ancora quello di dover essere pocco meno, che tutto il giorno sull'Arme; acciò il numeroso concorso dei Turchi, non apporti sconcerto alla materia della Salute, o sprezzi / 33^v la Pubblica forza, quando non è in stato di farsi rispettare.

Supposto di avere confutati a sufficienza gl'obbietti ritrovati, e che la proposizione venghi accordata in ogni sua parte, come lo richiede la grave importanza dell'oggetto, che impegna l'onorato mio zelo a questa fatica, per divvenire se fia possibile, in qualche

modo utile al buon Servizio del Principe, Mi resta poi da vincere un'altra obbiezione, ed è, che l'adempimento della proposta dovrà talvolta incontrare Sapendo, che alla Provincia, manca ben spesso la gran parte della Milizia regolata, qvale ci vorrebbe per formare l'Armo della nostra Linea colla forza di 5000 Soldati.

A questa difficoltà però si risponde, che non ritrovandosi nella Dalmazia al caso della riferita urgenza, un Corpo regolato della Nazione, qvale contenesse la forza voluta per l'interro Armo, allora si potrebbe levare tanti Vomini dalla Costa Marrina, ed Isole Rispettive, quanti ne occorresse a reclutare tutte le Compagnie che ci fossero, sino al numero di 100 Fazzioneri per ciasched' una, oltre li 2 Sargenti e 5 Caporali necessarj all' oggetto spiegato.

Quallora il numero delle Compagnie rinforzate dall Aumento che dissi, non bastasse a formare il Corpo dei 5000 Fanti, che ci occorrono, in qvel caso converrebbe di fare una levata / di tante Compagnie dai Contati della Provincia, qvante fossero le mancanti al compimento del Progetto; mà però fatte colla forza di 100 Fazzioneri e regolate in tutte le parti, sull'ordinario piede della Truppa Reggimentata della Nazione, per poi disporle con le ragioni del miglior Servizio alla Linea; mà innestate alle Compagnie del Piede vecchio, ed anche disporle lontano dalle natie aderenze di parentella, o di Amicizia; cosicchè se per defficienza dei modi, si fosse costretto di mettere in servizio li Territoriali Montani, e Confinanti, si farà sempre coll'avvertenza, che quelli di Knin debbano fazzionare à Imoschi, quelli di Sign, a Vergoraz, e Narenta, quelli d'Imoschi, Almissa, e Vergoraz, a Knin, e quelli di Narenta, e Macarsa, a Sign.

In aggiunta poi di quanto si è detto per il Composto della materia e sua disposizione agli appostamenti del Confine sarebbe ancora necessario di destinare due Vfficiali Graduati alla Sovurantendenza della Linea d'ogni Territorio, acciò dovessero a vicenda portarsi giornalmente a rivedere l'esattezza del Servizio incaricato all'Armo rispettivo, e farne i dovuti Rapporti a chi averà la Generale Sovurantendenza. /

Parimente sarebbe necessario di appoggiare la Sovurantendenza Generale di tutta la Linea divisa in due Ripparti, a due altri Vfficiali più Graduati dei primi; provveduti degl'opportuni mezzi per suplire al gravoso impegno della loro Ispezzione, dovessero con frequenza riconoscere la qualità della Vigilanza, che tutti

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prestano nell'ufficio rispettivo, e regolare in ogni Appostamento, quanto vi mancasse del buon ordine dovuto all'importanza dell'oggetto Salutare, Mà però sempre, colla dipendenza a quei Nobili alla Sanità, che vi dovrebbero essere, per togliere gl'abusi, e le competenze in ogni tempo dannose al buon Servizio, ed accertare col Personale riscontro, l'esistenza di tutta la forza destinata per ogni Posto Armato.

35* Poscia segvendo l'ordine dei regolamenti opportuni alle successive occorrenze di Salute converrebbe di formare un Ospedale alla Rustica in ogni Territorio, da situarsi nel Centro della rispettiva Linea; coi Capellani, Medici e Medicamenti necessarij a suffragare quelle Infermità della Milizia, che nei patimenti della continua fazione, sarà facile di contrarre, massime nella riggidezza del Verno, e nei cocenti ardori della State, dovendo servire gl'uni frà le asprezze dei Monti, dove manca il necessario al nutrimento, e insino / l'Acqua da bere, a gl'altri a marcirsi nelle Paludose stazioni della Narenta, ove le Pietre stesse cogl'Alberi portano in fronte la mala qualità dell'Aria, che vi risciede in ogni tempo dell'anno.

Sapendo poi coll'evvidenza del fatto, che la preparazione della materia richiede oltre li regolamenti accennati, anche le Provvidenze nutrimentose onde conservarla, e ridurla nell'attitudine di ben corrispondere agl'importanti oggetti del Pubblico Servizio, così alla Milizia disposta (come materia) nell'ufficio spinosissimo di custodire la Linea della Salute, si dourebbe contribuire la Paga d'Italia, per mantenersi con vigore nelle angustie della fatica, ed avere il modo di ripararsi dalle ingiurie del tempo rigido nel mezzo della Neve, che ordinariamente la circonda buona parte dell'anno.

35* Tutti questi provvedimenti, e soccorsi dei quali ho diffusamente parlato, mi sembrano relativi alla Reggia Munificenza del Principe, alla caritatevole disposizione di sì Eccelsa Repubblica, ed alla prudente massima di rendere sempre più gradito il suo Reale Servizio; poichè riguardano la conservazione, li Vantaggi, e la Salute de suoi Popoli, e servono ad eccitare maggiormente il dovuto fervore nell' / animo di quelli, che segvono la Gloria, ed il Lustrò dell'Armi, e delle Venete Insegne.

Mà come le disposizioni, che sono affluenti nella sola beneficenza, non bastano a ritenere in freno, e disciplina le Persone di mal

talento, ed i genj educati nella contrafazione dell'obbedienza dovuta alle provvide Leggi del Principe; così dourebbesi senza eccezione, o risserva passare per l'Armì chiunque ritrovato fosse nell'atto di violare le Salutari prescrizioni, che tendono alla Salvezza commune, e ad oggetto che l'esperimento riuscisse d'infallibile ritegno alli baldanzosi attentati contro la materia di Salute, convcrebbe d'eseguire istantaneamente il Santissimo Preccetto della Legge di Sanità; mà farlo nei siti della maggior frequenza, e negl'Appostamenti delle Stangate, lasciando esposto ad esempio il Cadavere, come reo di misfatto Esecrando; Poichè l'esperienza ne dice, che la certezza del castigo frena sul fatto la libertà del delitto, e la Disciplina col premio, fanno far tutto a tutti.

Passando dalla necessità di dover amministrare premio, e Castigo, come le sole qualità efficaci a promuovere il bene ed a rimuovere il male dalla materia disposta nel grave affare della Salute, dirò anche la ragione, che mi fa / preporre l'Armo da farsi colla regolata Milizia sopra la Linea presservatrice, a quello che si è praticato sino ad ora, coll'innesto dei Panduri, sia per defficienza dell'occorrente numero di Soldatesca, che per vista d'Ecconomia o per secondare le disposizioni, che in altre simili occorrenze si fecero, con buon esito, da chi gloriosamente presiedeva col Supremo incarico nella Provvincia.

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Tutta volta essendo variate nel rivolgimento di tant'anni le circostanze della Dalmazia, coi bvoni effetti di quelle Cause, che a me non giova di nominare, non si dovrebbe fare stupori, se più tali non sono le cose, che pur furono bvone in altro tempo; ne tampocco, se li Panduri, non sono più Idonei, come talvolta saranno stati, per custodire la Linea, e contribuire un utile Servizio al geloso Argomento della Salute; Poicchè oltre la Relazione di Parentella, che tengono, come sarò per dire, con tutto il Confine della Turchia, qvale nei tempi trascorsi, o non vi era, o sarà stata di poco riflesso, gl'è poi accaduto in successo di tempo un'altro sconcerto di conseguenza, ed è, che nonostante le molte terminazioni proibitive, furono ad ogni modo spogliati dell'armi loro col pretesto di qualche criminale, o d'altro apparente motivo che potesse / giustificarne l'estorsione. E però non saprei concepire, come possono corrispondere all'oggetto della disposizione, man-

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cando dei necessarij Stromenti all'offesa, e difesa, ne come possono riuscir fedeli nella gelosa custodia della Salute, ritrovandosi come sono nell'occasion prossima d'essere contaminati dalla forza dei motivi, che li circondano.

Qvallora gl'addotti motivi non bastassero a provare necessaria l'esclusiva dei Panduri dall'Armo della Linea, se vi unisse la difficoltà di renderli subordinati alle ordinazioni, e figura dei Capiposti, che sono per lo più Ufficiali della Truppa regolata, e se vi unisse la pretesa, che tengono li Collonelli, e Sardari delle Craine, di voler comandare ovunque sieno li Panduri loro; onde dalla discrepanza in cui sono gl'Ufficiali della milizia di accordarle il preteso diretto, ne derivano poi le contese d'Ordine, e li molti sconcerti a danno del Pubblico Servizio; qvesti disordini pertanto, non saranno mai rimossi, se non qvando l'Armo della Linea verrà composto interramente dai Soldati, ed Ufficiali della medema specie; ai qvalli sovurasta quell'autorità di Commando, che in forza della militar Disciplina, li costituisce dipendenti alle venerabili Leggi dell'obbedienza, sempre necessaria, per l'effetto voluto. /

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Ma posto anche, che il detto sin' ad ora, non inferisse alcun disordine, che porti a consegvenza, Vi sarà per lo meno quello, che deve produrre la necessità, in cui sono essi Panduri di mantenersi del proprio, quantunque la maggior parte sieno di tanta misera condizione, che non saprebbero campar la vita, senza l'emolumento angusto della giornaliera fatica; onde succede poi, che obligati dalla forza del Comando a passare negl'Appostamenti della Linea, con la provvigione di sei, o al più sette Oncie di Biscotto per giorno (essendole defraudato il restante della libra, che il Principe le accorda durante la Fazione), si mangiano in quattro giorni quel Pane, che deve servir loro di nutrimento per otto; e dopo ciò, col pretesto giustificante di dover andare a Casa per provvedersi da vivere, abbandonano il Posto, e talvolta senza più ritornarvi.

Io vidi qvesto, quando fui, come già dissi, a riconoscere l'estesa del nostro Confine coll'Ottomano, e feci particolar osservazione sopra lo Stato dei Caselli della Linea, qvalli, oltre la mala qualità dell'Armo rispettivo, erano anche in troppa distanza l'un dall'altro; cosicchè le naturali framesse opposizioni dei Boschi / Valloni, e Prominenze, toglievano a buona parte di loro, la libertà della rispettiva Visuale. Dunque a Villici Montanari, pratici come sono

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di quelle Situazioni, era poi facile il passaggio, e ritorno clandestino a traverso della nostra Linea; e massime di notte, o nelle giornate tempestose, che per la malagevolezza di quei luoghi, non era possibile di fare la consueta Ronda colle Pattuglie staccate dagl'Appostamenti principali.

In segvela delle mie osservazioni dirò, che ritrovai disperse in tutta la Linea dieciotto Compagnie della Nazione, qvali dovendo ritenere il maggior numero della loro forza nei Posti principali, non potevano contribuire, se non un Soldato per ogn'altro Casello minore; cosicchè non essendo nella Provincia altre Compagnie Nazionali, e dovendo supplire alla defficienza dell'armo dei Caselli, furono per necessità sostituiti tanti Panduri, qvanti ne occorreva per sostenere unitamente ai pochi Soldati, tutto quel peso, che annesso si ritrova all'ufficio di custodire una Linea armata, per oggetti di Salute.

In fatto viddi gl'espressi Territoriali disposti nei molti Caselli della Linea, con qualche Soldato, che la poca forza delle Compagnie destinate a quell'ufficio, vi poteva / contribuire; Ma viddi ancora, 38^r quanto erano mal proprj ad effettuare l'oggetto della Pubblica intenzione; mentre alcuni di essi non avevano Schioppi, e quelli che pure avevano, non erano da prestare servizio, stante le imperfezioni contratte dal tempo, e dalla mala qualità dell'Arma stessa, e stante, che niuno di loro teneva un grano di Polvere. E in fine vidi, che tutti dimostravano le marche della povertà rispettiva, ed insieme quella della svogliatezza prodottale dal grave peso della Fazione, senza i modi di poterlo sostenere.

Una delle primarie caggioni del di loro scontento, era il vedersi obbligati ad abbandonare con frequenza gl'Uffizi più necessarj al mantenimento delle rispettive Famiglie, per poi supplire in aggiunta delle propric alle Fazioni di quelli, che ad onta delle più rigorose proibizioni, venivano dagl'Inferiori Capi loro, dispensati, a prezzo di Dannaro, dal Publico Servizio.

Qvalora mai si potesse accordare giustificazione alla reità di fraudolenza, sarà sempre coi rapporti del maggiore, o minor male, che possono inferire; ma in questo caso si unisse all'ingiusto agravio del particolare, anche il pericolo massimo di rapire all'universale il maggiore / dei beni della Terra : Tuttavolta questo Capi, 38^r hanno molti pesi da sostenere con tenuissimo assegnamento mensile, o converrebbe di rimuoverli, parlando di quei tali, che

così fanno, per sostituirne dei migliori, se fia possibile; ovvero provvederli di modi a sufficienza, per mantenersi onesti, e castigare dopo, chiunque abusasse del carico Rispettivo.

Ritrovandosi dunque lo Stato delle cose nel modo riferito, convien dire, che quantunque l'importanza del motivo, per cui si tiene armata la Linea, richiede particolar fervore nel custodirla; nonostante, vi è molto da temere, che li Panduri mal contenti per le cause dichiarate, abbiano l'animo bene disposto a contribuirvi la loro diligenza. Mà qualora non bastassero gl'espressi motivi a renderli poco interessati nell'ufficio della Salute, se ne aggiunge un'altro, che incerto modo li costringe a divenire assistenti alle reità praticate con frequenza dai Consanguinei loro, appunto per li motivi, dei quali ho già fatto breve Ceno, ma che però devo a miglior chiarezza replicarli, come segue.

39^r Nell'ultima Pace (49) stabilita coll'Ottomano, la Linea del Confine, fu condotta con tale direzione, che face rimanere dalla parte del Turco le alture dei Monti, che formano la separazione della nostra Dalmazia dalla Bossina / e Ducato di San Saba, o sia Erzegovina, e relativamente a questo, vi furono comprese le Terre da coltivare, coi luoghi da pascolo, situati frà li Monti stessi; onde mancando ai nostri Sudditi prossimi al Confine li Pascoli, e la Terra di cui abbisognano, prendono ad affitto tutto ciò dai Turchi proprietarj, e poi vi tengono un commune Domicilio con li Parenti, che lavorano nello Stato della Republica. In questo modo, si forma in due Stazioni la Famiglia di un Padre stesso, e si vede tutto il Confine ripieno de queste Case dimezzate; ma particolarmente abbondano in quello, che appartiene alli due Contati di Knin, e Sign, come li più estesi, e li più numerosi di popolazione.

39^r Da questo ne succede poi di conseguenza, che nel fissare la Linea di Salute sul Confine, vengono Segregati li fratelli e Germani abitatori oltre la Linea sul Turco, dalli Germani, e Fratelli abitatori nello Stato Nostro; cosicchè dovendo per mancanza di Milizia Regolata destinare gl'accennati Sudditi Territoriali alla custodia dei Passaggi, non è molto probabile, o ragionevole di supporre, che nella reciproca volontà di comunicare gl'uni cogl'altri, si astenghino questi di andare in Turchia, ovvero arrestino quelli / al Posto quando le viene proposito di trasferirsi a noi ed ecco dimostrata la facilità d'introdurre la contaminazione nella Provincia, ed anche provata coll'evidenza del fatto la buona ragione

di non ammettere Panduri alla custodia della nostra Linea di Salute; mà solo Truppa regolata colla forza, e condizioni, che già dissi.

Dopo la fatta esposizione del pericolo, a cui è soggetta la Dalmazia, e dopo quello dei modi proposti alla necessità della sua difesa, non saprei allungare di vantaggio l'Argomento, se non col timore di riuscir prolisso sino al grado di tediare; ovvero di non esser gradito da quelli, ai quali fu riservato da Dio il giudizio del merito altrvi, ed insieme la facoltà del rimedio ai mali, che molestar potessero la felicità di questo Clima.

Questi appunto sono essi loro, che per diritto di natura sortirono colle Splendore della nascita la Sublimità del Talento, ed anche la Scienza del buon Governo dei Popoli; onde senza farle tediose digressioni al proposito, saranno già persuasi dalla chiarezza delle addotte ragioni, e dal fatto stesso, che lo Stabilimento del nuovo Lazzaretto sopra l'Isoletta di *Ham* sia necessario per cautelare la Provincia da ogni contaminazione derivativa dal / Comercio, e che necessario egualmente sia l'Armo della Linea nei modi espressi, per ca[u]tellare, e custodire a tutta difesa il nostro Confine dai Contagiosi attacchi.

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Nel Supposto d'aver provata coll'evidenza della addotte ragioni la verità del mio Assunto, non mi resta che di fare pochi Cenni sopra la necessità del Pubblico dispendio per effettuarlo; quale, se mai divenisse l'obbietto della mia proposizione dovrò cedere il Campo ai diritti della sua Potenza, ed attendere con Divoto Silenzio tutto quell'esito migliore, che dalle di lui conseguenze ci sarà prodotto al fine.

Tutta volta riflettendo all'importanza dell'argomento della Salute, dirò coll'umiltà del mio Rispetto, che ogni dispendio qualunque sia, purchè si facci con opportunità di tempo, e coi rapporti corrispondenti alla difesa dello Stato, egli diviene talmente proficuo ne suoi effetti, quantocchè l'utilità dei prodotti, acquista il privilegio di farle cangiare nome in favore del beneficio, che al Pubblico, ed al Privato ne deriva; poicchè presserva in uno le Sostanze, coi Sudditi, che la Peste divora, e risparmia quei Tesori al Principe, che già viene costretto a diffondere in coppia maggiore, nel riparo di quelle / desolazioni luttuose; quali sono le funeste conseguenze del prodotto Contagioso, quando a tutta forza, non si ributti addietro dal Confine, e se gli vieti l'ingresso ad ogni passo.

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Con questo avrò dato fine alla veridica Narrazione, di quanto successe, per effetto dell'ultimo Contaggio nei Borghi di Spalato, ed avrò parimente compiuta l'estesa delle ragioni favorevoli al Progetto; qvali riguarda la necessaria difesa della Dalmazia, contro le future molestissime insorgenze della Peste, che Iddio Signore si tenga sempre lontana.

Devo però a mia devota giustificazione avvertire chi legge, che quantunqve non abbia Veste per far Progetti, ne sia chiamato a dare raccordi alla proffonda Sapienza di questo Serenissimo Governo; pure il Zelo che sento, come Soldato di Vecchia data, per il miglior Servizio dell'Adorato mio Principe, mi costringe a sorpassare l'idea d'una tale risserva, senza per altro eccedere di un momento li Sacratì Vincoli della più rispettosa dipendenza a lui dovuta.

41^a Li miei Progenitori, ebbero la sorte Gloriosa di poter coll'effusione del proprio Sangue, attestare all'Augusta / grandezza di questo invitto Principe la qvalità della Fede, con cui le prestarono, nelle molte Battaglie di Terra, e Mare, un onorato Servizio, ma io non potendo, come loro, acqvistare il merito dei Cimenti personali, che la differente condizione del tempo non concede, le offre in vece questo tenuissimo prodotto delle mie applicazioni, col vivo desiderio, che riescano utili al suo Regale Servizio, e con quello di poter meritare gl'effetti graziosi di quel umanissimo Compatimento, che dall'innata sua Clemenza, con umiltà divota imploro.

Grazie.

Piedilista della Forza regolata, che a tenore del Progetto appare disposta nell'Armo della nostra Linea, e ciò coi rapporti dell'estesa, ch'ogni Territorio Montano deve Pressidiare al Confine della Turchia in tempo di sospetti Contaggiosì.

Territorj	Graduati	Capitani	Alfieri Direttori	Sargenti Direttori	Caporali Direttori	Vice Caporali Direttori	N° de Soldati disposti contro li Vice Caporali	N° de Caselli d'Ogni Riparto, e di tutta la Linea
Knin	2	9	13	26	44	68	1315	160
Sign	2	8	11	23	38	60	1187	140
Imoschi	2	10	14	26	44	66	1347	160
Vergoraz	2	3	4	8	13	22	415	50
Narenta	2	5	7	15	24	39	736	90
Somma	10	35	49	98	163	255	5000	600

Le R. P. Henri Bosmans, S. J. (1852-1928)

Notice biographique et index analytique de ses travaux historiques.

La carrière du R. P. HENRI BOSMANS est vite racontée : né à Malines (Belgique) le 7 Avril 1852, il entre au noviciat des jésuites en 1871. Après ses études, il est attaché au collège Sainte-Barbe à Gand. En 1887 il devient professeur de mathématiques au collège Saint-Michel à Bruxelles, puis préfet des études au même collège. Et le 3 Février 1928, comme l'a écrit un de ses confrères (1) « il quitta ses amis aussi simplement qu'on le voyait disparaître de son pas égal, un livre sous le bras, au détour d'une rue ». C'est une vie toute en ligne droite.

Ce qui ne veut pas dire que cette vie fut toujours facile. C'est plutôt à force d'énergie qu'il a gardé constamment la même direction. Pour nous en tenir à sa carrière scientifique, on croirait difficilement qu'un œuvre si long, et dont une partie seulement a été imprimée, est du travail fait après la besogne des cours ou de la direction, et fait par un homme dont la vue était mauvaise, et menacé à tout instant de n'y plus voir du tout. Il avait même eu une période de cécité complète, débutant brusquement, en pleine rue de Rennes à Paris, un jour qu'il revenait de la Bibliothèque Nationale. Au bout de quelques mois, la vue lui revint un peu. Mais il fallait avoir l'imagination bien réglée pour se remettre aussitôt à la besogne, comme s'il n'y avait rien eu. Surtout que la besogne, c'était de lire à ses moments perdus, de vieux grimoires griffonnés par des savants d'un autre âge.

Le débutant historien des sciences qui se hasardait à attendre le R. P. BOSMANS devant la porte de sa cellule, blottie sous la bibliothèque des Bollandistes à Bruxelles, pouvait être certain d'un

(1) R. P. PEETERS. Le R. P. Henri Bosmans S. J. dans *Revue des Questions scientifiques* 4^e S. 13 (1928) p. 201-214. cfr. R. P. MISSON dans *Le Compas d'or* 6 (1928) p. 164.

cordial accueil dès qu'arrivait le vieil érudit. C'était alors une pluie de renseignements sur toutes sortes de sujets, une avalanche d'érudition exposée avec bonhomie, en toute simplicité, et sans avoir l'air de se douter qu'il se jouait parmi des notions souvent bien embrouillées, que les pauvres novices ès sciences n'arrivaient pas toujours à suivre. Et puis les nouvelles brochures, et les renseignements bibliographiques. Il savait où se trouve l'opuscule rare, et grâce à ses furetages dans les bibliothèques grandes et petites, arrivait à se procurer les données qu'un moins habile aurait dû aller chercher à Londres ou à Paris. Le tout pêle mêle avec des conseils au débutant sur son petit essai en cours : si discrets parfois qu'il fallait y regarder de près pour voir sur quoi ils portaient. L'objection pouvait prendre la forme d'un simple renvoi à l'un ou l'autre passage de l'Almageste. Il ne la poussait pas plus avant, et laissait à l'apprenti la surprise de trouver tout seul qu'il faudrait, mettons, remanier fortement le passage en litige. On était étonné de voir jusqu'à quel point il connaissait les mathématiciens de l'antiquité, lui qui n'a pour ainsi dire rien publié sur eux. Cette connaissance approfondie est caractéristique de sa manière de travailler : il étudiait les savants de la Renaissance ; or ils sont sous l'influence des ARCHIMÈDE et des APOLLONIUS. Donc pour avoir le droit d'en parler, il faut d'abord connaître, et bien connaître, et lire dans l'original, les ARCHIMÈDE et les APOLLONIUS. C'était pour lui une loi qu'il n'a jamais transgressée, de ne pas avancer un fait sans l'avoir contrôlé dans les sources.

Un autre principe était de ne jamais publier un article sans avoir du neuf à dire sur la question. L'illustre bollandiste qui s'est chargé de son éloge dans la *Revue des Questions scientifiques*, soulignait fort bien ce caractère de l'œuvre du P. BOSMANS, et proposait qu'on en dressât une bibliographie critique, où l'on indiquerait à propos de chacun des travaux mentionnés, en quel état l'auteur avait trouvé la question, jusqu'où il l'a menée, et ce qu'on a fait depuis. Ce serait malheureusement un travail énorme, et qu'au surplus, seul un spécialiste des mathématiques de la Renaissance pourrait aborder. Et pourtant, il n'y a pas d'autre moyen de faire rendre justice à un érudit, dont l'œuvre a eu le sort de tous les travaux spécialisés : seuls les connaissent un petit cercle d'initiés. Mais parmi ceux qui lui écrivaient,

et qui, à l'occasion, ne dédaignaient pas de lui demander son avis, on trouve tous ceux qui ont compté dans l'histoire des sciences depuis une trentaine d'années. Leur témoignage vaut mieux sans doute que celui du « general reader », grand admirateur, d'ordinaire, de la jolie bulle de savon.

L'œuvre historique du P. BOSMANS, considéré dans son ensemble, présente une unité remarquable. Le centre en est formé par les études sur les jésuites belges mathématiciens du XVII^e siècle : La province belge de cette compagnie avait produit toute une pléiade de savants, dont quelques uns de premier ordre, comme GRÉGOIRE DE SAINT-VINCENT, ou TACQUET; et dont d'autres avaient eu un rôle important dans l'acclimatation en Chine de la science européenne. Pour connaître et comprendre le groupe qui travaillait en Europe, il fallait étudier le monde scientifique de leur époque, et du siècle précédent.

Il était d'autant plus poussé vers ce travail, que la bibliothèque de l'Université de Louvain était extrêmement riche en ouvrages mathématiques de la Renaissance : la bibliothèque d'ADRIEN ROMAIN, entre autres, s'y trouvait rassemblée; et pour l'amateur de livres rares qu'était le P. BOSMANS, il y avait là de quoi faire des découvertes grandes et petites tant qu'il voulait. On s'aperçoit bien vite qu'il explorait ce trésor très soigneusement, et il est à souhaiter que l'on garde bien les notes qu'il n'a pas publiées, car, en certains cas, elles se trouvent être le seul renseignement qu'il soit possible d'avoir sur des ouvrages disparus dans l'incendie. Il n'y avait pas que Louvain. La bibliothèque royale de Bruxelles était mieux à sa portée, et le P. VAN DEN GHEYN, lorsqu'il la dirigeait, lui avait même demandé d'y faire le relevé des manuscrits mathématiques : l'on reconnaît sa typique écriture en bien des places de l'inventaire provisoire. Ce sont presque uniquement les mathématiciens de France et des Pays Bas qui ont retenu son attention. Il avait l'avantage de pouvoir lire les STEVIN et les HUYGENS dans l'original. Il a lui-même indiqué jusqu'où l'on pouvait se fier à l'édition française du premier.

Sur la science en Europe au XVI^e et au XVII^e siècle, il a donc recueilli quantité de documents. Il ne les a pas tous publiés, et pourtant l'on verra qu'il a écrit beaucoup, dans un domaine où un article n'est pas vite rédigé.

Trouvant tant de choses sur les savants belges restés au pays,

le P. BOSMANS s'était dit que l'étude de la correspondance des missionnaires en Chine lui livrerait encore plus. Le sujet était neuf : les « Lettres édifiantes et curieuses » commencent, si je ne me trompe, au XVIII^e siècle. Or au XVII^e, s'était passé un fait extrêmement intéressant : les missionnaires jésuites avaient été remarqués par l'empereur de Chine comme astronomes possédant des méthodes plus exactes que les mandarins chinois ou les disciples de l'école arabe. Et même, s'il tolérât, un peu à son corps défendant, que l'on prêchât le christianisme, c'est parceque les jésuites lui constituaient un « tribunal des mathématiques » capable de mettre en ordre son calendrier, et de lui prédire les éclipses avec une approximation suffisante. Ce dernier point était de la plus haute importance, faut-il croire ; aussi voyons-nous les bons pères assez nerveux à la première éclipse qui suivit la mort du P. VERBIEST : si jamais on avait fait une faute de calcul ? Dans les archives, le P. BOSMANS trouva beaucoup, mais pas ce qu'il cherchait : les lettres de missionnaires contenaient beaucoup plus de « personalia » que de mémoires scientifiques, et c'est assez naturel. Il sauva de l'oubli de ses compatriotes le P. VERBIEST, publia de nombreux documents fort instructifs pour l'historien des relations des européens avec l'Extrême Orient ; mais il ne cachait pas qu'il avait eu une désillusion. Ce n'est pas que l'œuvre scientifique de ces missionnaires n'ait pas été considérable : ils ont fait connaître les mathématiques et l'astronomie européenne aux lettrés chinois ; ils ont entrepris de reconnaître les routes par terre entre la Chine et l'Inde, même entre le proche et l'Extrême Orient ; en 1710, ils trouvent qu'un degré de méridien n'a pas la même longueur partout. Il n'a pas eu la chance de mettre la main sur le document sensationnel au point de vue de l'histoire des sciences, mais il en a exhumés qui ne manquent pas d'intérêt pour l'historien tout court.

Si l'on veut caractériser d'un mot le travail du P. BOSMANS, on devra, croyons-nous, l'appeler plutôt un érudit qu'un historien. L'ouvrage d'ensemble ne le tentait guère. Et ce n'est pas à lui qu'on reprochera « d'avoir remis ses héros dans leur cadre » — car le mot fait peur, paraît-il, à certaines gens. Serait-ce peut-être son souci d'exactitude minutieuse qui l'arrêtait ? Certaines de ses façons de parler sembleraient le faire croire. Il faut bien avouer que plus la synthèse est large, plus on est amené à parler de sujets

que l'on connaît moins bien. Sans marchander son admiration aux grandes constructions historiques, il préférerait les laisser à autrui, aimant mieux faire une bonne brique qu'une belle maison.

Parfois, il a rassemblé en un seul article ses travaux sur un personnage. C'est en s'excusant qu'il l'a fait, et en considérant ce travail comme un résumé : Résumé d'ailleurs utile, parceque ses petites œuvres sont dispersées un peu partout, et parfois dans des périodiques peu répandus; et travail où se montrait le fil conducteur qui avait guidé ses études sur le personnage en question : il est impossible d'échapper complètement à la synthèse.

Nous allons, dans la bibliographie qui suit, essayer de donner une idée du contenu des ouvrages du P. BOSMANS : nous pensons que ce n'est pas inutile, vu l'état d'extrême dispersion de son œuvre. Nous nous arrêterons de préférence aux mémoires que nous pensons moins accessibles à la majorité des lecteurs. D'un autre côté, on ne résume pas un résumé : nous ne pourrions donc qu'indiquer d'un mot les articles où sont analysées, parfois en détails, les œuvres de mathématiciens anciens. Et cela provoquera un résultat paradoxal : de petits travaux seront mentionnés en plus de mots que des grands. Nous prions aussi le lecteur de se rappeler que les résumés de ces ouvrages sur les mathématiciens du XVI^e et du XVII^e siècle sont faits par un philologue classique. Moins donc que tout autre sommaire, ils dispenseront d'avoir recours à l'original. Nous avons du reste été aidés par M. l'abbé LEMAITRE, professeur à la faculté des sciences de l'université de Louvain, et par les RR. PP. LEFÈVRE et DOPP S. J., professeurs au collège philosophique S. J. de Louvain, auxquels nous exprimons nos remerciements.

(Louvain)

A. ROME.

Bibliographie des travaux historiques du R. P. Henri Bosmans, S. J.

Note. — Nous avons omis les comptes rendus de livres, fort nombreux, qui se trouvent dans la *Revue des Questions scientifiques* (Bruxelles) et ailleurs. L'auteur avait l'habitude, un peu comme son ami P. TANNERY, de transformer ces recensions en de petits articles, où il mettait tout ce qu'il avait à ajouter au livre qu'il avait lu. On ne perd donc pas son temps à relire ces critiques. Mais mentionner les endroits où l'on

trouverait une contribution intéressante à l'histoire des sciences rédigée sous cette forme là, grossirait démesurément notre travail.

Outre ces critiques de livres, le P. BOSMANS donnait régulièrement un Bulletin d'histoire des mathématiques dans la *Revue des Questions scientifiques*. Nous n'en avons retenu que l'une ou l'autre publication de documents inédits. Mentionnons seulement, parcequ'elles font saisir une idée chère à l'auteur, et dont nous n'avons pas eu l'occasion de parler, les critiques, parues dans divers périodiques, des traductions françaises de mathématiciens grecs par M. VER EECKE (Bruges, DESCLÉE) : le P. BOSMANS était enthousiaste du procédé de l'érudit anversoïsois, qui traduit le texte au lieu de le transposer en notations modernes. La dernière impression qu'il ait corrigée lui-même est un article sur le THÉODOSE DE TRIPOLI de cette collection. Il n'a pas connu celui de HEIBERG.

Nous avons dû faire des coupes, forcément arbitraires, dans les réponses parues soit sous son nom, soit sous le pseudonyme H. BRAID dans l'*Intermédiaire des mathématiciens* (Paris 1894 à 1926). Le même traitement a dû être infligé aux « *Kleine Bemerkungen* » de *Bibliotheca mathematica* (3 Folge. 1900-1914). En Octobre 1914, dans la *Revue des Questions scientifiques*, l'auteur résumait le débat, sans savoir que *Bibliotheca mathematica* ne reparaitrait plus, et signalait qu'au début, tous les historiens avaient collaboré à cette mise au point de l'œuvre de CANTOR. Mais peu à peu, le ton « a perdu de sa sérénité ».

ANTIQUITÉ.

1. Préface à O. GILLAIN. La science égyptienne. L'arithmétique au moyen empire. Bruxelles. Fondation égyptologique Reine Elisabeth 1927. pp. xvi in 8°.

En quoi les grecs dépendent des égyptiens. Ces derniers ont-ils connu la multiplication, opération qu'il faut distinguer de la duplication ?

XII^e Siècle.

2. **Jordan de Nemore.** Le Philotechnes de JORDAN DE NEMORE, d'après P. DUHEM et le manuscrit de cet ouvrage possédé par la bibliothèque de la ville de Bruges. *Revue des Questions scientifiques* Janv. 1923 (tiré à part, pp. 16 in 8°).

[cfr P. DUHEM. Les origines de la statique, dans *Rev. Quest. scient.* de 54 (1904) à 60 (1906) et Paris, HERMANN 1905-1906. — P. DUHEM. Un ouvrage perdu cité par JORDAN DE NEMORE : le Philotechnes, dans *Bibliotheca mathematica* N. F. 5 (1904) p. 321-325]. L'auteur démontre que ce Philotechnes est le traité « *De triangulis* » publié par M. CURTZE. Thorn 1887.

XIII^e Siècle.

3. **Guillaume de Moerbeke.** GUILLEAUME de Moerbeke et le traité des corps flottants d'ARCHIMÈDE. *Rev. Quest. scient.* 4^e S. 1 (1922) pp. 370-388.

Aucune biographie ni bibliographie détaillée n'existe de GUILLEAUME, de Moerbeke lez Grammont (Belgique). L'auteur donne une brève notice sur le célèbre dominicain, pénitencier du pape, archevêque de Corinthe, protecteur de savants comme VITELLION et HENRI BATE, et traducteur d'ARCHIMÈDE plagié par TARTAGLIA.

4. **Jean de Sacrobosco.** Sur l'auteur d'un traité d'algorisme contenu dans le ms. D 372 de la bibliothèque reconstituée de l'Université de Louvain. *Annales de la société scientifique de Bruxelles.* 44 (1924) pp. 458-462.

XVI^e Siècle.

5. **Pierre Apian.** Sur un exemplaire du *Cosmographicus liber* de PIERRE APIAN, éd. d'Anvers 1533, donné à la bibliothèque de l'Université de Louvain. *Ann. soc. scient.* 41 (1920) p. 203.

6. **Buteo.** « *Kleine Bemerkungen* ». *Bibl. math.* 3 F. 7 (1906) p. 91.

CANTOR 2 : 561 — Au 3^e livre de sa logistique, BUTEO emploie parfois des équations dont le second membre est nul.

7. **Michel Coignet.** Le traité des sinus de M. COIGNET (1549-1623). *Ann. soc. scient.* 25 (1901) p. 91-170.

Notice sur COIGNET, mathématicien et ingénieur des archiducs ALBERT et ISABELLE. Ses principaux travaux sont inédits, plusieurs sont perdus. L'auteur a trouvé à la bibliothèque royale de Bruxelles (ms. II 769) plusieurs petits traités en français. Il édite avec notes le *Traité des sinus* (qui dans le ms. est suivi d'une table des sinus), résume le *Traité des triangles plans*, et indique le contenu du *Traité du pantomètre* (règle portant 12 graduations permettant de résoudre divers problèmes).

8. **Copernic.** « *Kleine Bemerkungen* ». *Bibl. math.* 3 F. 9 (1909) p. 251.

CANTOR 2 : 474. VON BRAUNMÜHL I p. 140-141 (éd. 1899) a raison : l'édition de 1542 du *De lateribus* montre que les variantes du *de lateribus* et du *de revolutionibus* sont de peu d'importance.

9. **Gemma Frisius.** Le commentaire de GEMMA FRISIUS sur l'*arithmetica integra* de STIFEL. *Ann. soc. scient.* 30 (1906). p. 165-168 [ce titre est celui des tirés à part].

En marge d'un volume détruit dans l'incendie de Louvain, GEMMA FRISIUS avait écrit différentes notes. Entre autres, il réfutait la duplication du cube

comme CANTOR. Vorlesungen 2^e éd. t. 2 p. 410. En un autre endroit, il ajoute une démonstration de la règle des signes. GEMMA en voulait à STIFEL d'avoir adopté la « complication inutile » de désigner par des lettres différentes les diverses inconnues. Somme toute, il admirait STIFEL.

10. **Albert Girard.** ALBERT GIRARD et VIÈTE, à propos de la théorie de la syncrèse de ce dernier. *Ann. soc. scient.* 45 (1925) p. 35.

Dans l'« Invention nouvelle », Amsterdam 1629, GIRARD affirme que l'équation : $x^m + B x^{m-3} + \dots = A x^{m-1} + C x^{m-3} + \dots$

1^o possède m racines

2^o ces racines étant $x_1, x_2, x_3 \dots$ on a : $\Sigma x_1 = A$; $\Sigma x_1 x_2 = B$ etc.

Ce second théorème lui sera venu à l'esprit après l'étude de la syncrèse de VIÈTE. En passant, GIRARD calcule la somme des puissances semblables, jusqu'à la 4^e, des racines de l'équation.

11. **Albert Girard.** La trigonométrie d'ALBERT GIRARD. *Mathesis* 40 (1926). p. 337-348 + 385-392 + 433-439.

La « table des sinus » (1626) contient un précis de trigonométrie rectiligne et sphérique. L'« invention nouvelle », dernière partie (1629) parle de la superficie des triangles et polygones sphériques. L'édition 1627 de la table n'est qu'un nouveau tirage, auquel on a ajouté un appendice de quatre feuillets. L'auteur analyse le précis de trigonométrie.

12. **Albert Girard.** La théorie des équations dans l'« Invention nouvelle en algèbre » d'A. GIRARD. *Mathesis* 40 (1926) p. 59-67 + 100-105 + 145-155.

L'arithmétique de STEVIN est le seul ouvrage auquel GIRARD n'ait pas ajouté de notes en le rééditant : il a publié à part ses idées sur le sujet dans son « Invention nouvelle ». TERQUEM a analysé cet ouvrage sans connaître STEVIN. Or l'Invention nouvelle est toute entière écrite sous l'influence de l'Arithmétique. L'auteur revient sur les idées exprimées dans l'article qui vient d'être résumé (cfr n^o 11). GIRARD est le premier à donner une interprétation géométrique des racines négatives. L'auteur analyse la théorie des équations, qui constitue la seconde partie de l'Invention : Equation du 3^e degré; solution trigonométrique du cas irréductible; lorsque GIRARD a trouvé une racine, il en profite pour abaisser d'une unité le degré de l'équation, mais jamais en divisant par $(x-x_1)$: il applique ses théorèmes sur les racines des équations. Les équations à plusieurs inconnues.

13. **Guillaume Gosselin.** Le de arte magna de G. GOSSELIN. *Bibl. math.* 3 F. (1906) 7 p. 44-66.

CANTOR n'a pas vu le de arte magna de GOSSELIN. L'auteur en connaît trois exemplaires en Belgique (l'un d'eux est actuellement détruit). Les contemporains l'égalèrent presque aux œuvres les plus célèbres. L'auteur l'analyse et conclut que GOSSELIN est un vulgarisateur ayant l'art de mettre les découvertes des autres à la portée du plus grand nombre des savants.

14. Liévin Hulsius. « Kleine Bemerkungen ». *Bibl. math.* 3 F. 8 (1907) p. 89.

CANTOR 2 : 689. ZIGLER écrivant à KEPLER, le 1 Août 1606 parle de HULSIUS comme étant déjà mort.

15. Liévin Hulsius. Quel fut l'auteur du « De Quadrante Geometrico libellus » édité à Nuremberg en 1594 aux frais de CORNEILLE DE JODE ? *Rev. Quest. scient.* 3^e S. 28 (1920) p. 167-179.

Il existe cinq exemplaires de cette plaquette, qui a été publiée en allemand la même année [cfr DOPPELMAYER. *Historische Nachricht von den nürnbergischer Mathematicis*. Nuremberg 1730. — p. 163-164. Et ENESTRÖM dans *Bibl. Math.* 3 F. 4 (1903) p. 403]. DE JODE a fait graver les dessins de sa brochure en partie d'après les données de MARTIN GEET de Douai; et le texte a été rédigé par HULSIUS, qui vendait les instruments. C'est un prospectus savant, comme en éditent encore les constructeurs d'appareils.

16. Neper. Sur un exemplaire de la Rabdologic de NEPER qui a échappé à l'incendie de la bibliothèque de l'université de Louvain. *Ann. soc. scient.* 39 (1919) p. 104.

L'ouvrage était en lecture en Août 1914.

17. Pedro Nuñez (Nonius). Sur le libro de algebra de PEDRO NUÑEZ. *Bibl. math.* 3 F. 8 (1908) p. 154-169.

L'original portugais a disparu. Il existe une traduction latine par JEAN PRETORIUS et une traduction française par G. DE RASCAS. La traduction espagnole (Anvers Stralsius 1567) est de NUÑEZ lui-même. L'auteur indique en quoi NUÑEZ est original. Il dépend de JORDAN DE NEMORE, et a eu de l'influence sur ADRIEN ROMAIN. C'est même l'exemplaire (détruit depuis) d'A. ROMAIN qui a servi à l'auteur à faire son travail.

18. Pedro Nuñez. L'algèbre de PEDRO NUÑEZ. *Annaes da academia polytechnica do Porto* 3 (1908) Coimbra 1908 pp. 50 in 8.

P. NUÑEZ a crû assurer à son algèbre une large diffusion en l'éditant en espagnol à Anvers. C'est le contraire qui est arrivé. L'auteur analyse complètement l'ouvrage.

19. Jacques Peletier. L'algèbre de JACQUES PELETIER du Mans departie an deus livres. *Rev. quest. scient.* 3^e S. 11 (1907) p. 117-173.

Prosateur, poète, mathématicien, avocat, médecin, inventeur d'une orthographe biscornue. L'auteur analyse en détails son algèbre. Voir aussi « Kleine Bemerkungen » *Bibl. Math.* 3 F. 6 (1906) p. 402.

20. Nicolas Petri. La « practique om te leeren cypheren » de NICOLAS PETRI de Deventer. *Ann. soc. scient.* 32 (1908) mémoires p. 272-301.

Notice biographique sur NICOLAS PETRI. Analyse de son ouvrage. dans

lequel tous les Pays Bas ont appris l'arithmétique au XVI^e siècle. Note sur les sources de PETRI.

21. **Adrien Romain.** La méthode d'A. ROMAIN pour effectuer les calculs des grands nombres. *Ann. soc. scient.* 28 (1904) mém. p. 411-429.

Nova multiplicandi, dividendi, quadrata componendi, radices extrahendi ratio, multo quam pervulgata certior, faciliior, et majoribus maxime numeris accomodator, authore A. ROMANO, E. A. publié d'après le cod. 196 S. xvi de l'université de Louvain (actuellement détruit).

Le même cod. contenait le commentaire sur la sphère de SACROBOSCO par JACQUES NIVELLES (1565-1598) et aussi le Tractatus de notatione numerum authore ADRIANO ROMANO equite aurato.

22. **Adrien Romain.** Analyse du « problema apolloniacum », de la « chordarum arcubus circuli primariis quibus videlicet is in triginta dirimitur partes subtentarum resolutio »; et du « mathematicae analyseos triumphus in quo lateris enneagoni inscripti ad radium circuli exhibetur ratio » d'ADRIEN ROMAIN. *Ann. soc. scient.* 29 (1905) p. 68-79.

Le problema apolloniacum est la construction d'une circonférence tangente à trois cercles donnés. Le titre des autres ouvrages dit assez leur contenu.

23. **Adrien Romain.** Note sur la trigonométrie d'ADRIEN ROMAIN. *Bibl. math.* 3 F. 5 (1905) p. 342-354.

Outre le canon triangulorum sphæricorum, ADRIEN ROMAIN a écrit le canon triangulorum rectangulorum; le speculum astronomicum, et mathesis polemica. L'auteur analyse les trois ouvrages, dont le premier et le troisième sont extrêmement rares.

24. **Adrien Romain.** Le fragment du commentaire d'ADRIEN ROMAIN sur l'algèbre de MUHAMED BEN MUSA EL CHOWAREZEMI. *Ann. soc. scient.* 30 (1906) mémoires p. 267-287.

Il n'existe plus qu'un seul exemplaire (à Douai) de cet ouvrage inachevé. L'auteur le décrit d'après l'exemplaire de l'ancienne bibliothèque de Louvain pp. 72 in fol. sans titre, ni préface, ni dédicace. Il doit avoir été imprimé à Wurzburg entre 1597 et 1603. Probablement en 1598-99. ROMAIN travaillait sur la traduction de ROBERT DE RÉTINES. Il dresse une bibliographie de l'algèbre et fait l'historique de la théorie des équations. L'auteur montre que l'ouvrage est resté inachevé, sans doute à cause des difficultés typographiques qu'il présentait. La bibliothèque d'ADRIEN ROMAIN, qui se déplaçait souvent, était restée à Louvain. Le commentaire a toujours été fort rare, et a eu peu d'influence. Mais les notations de ROMAIN étaient connues aux Pays Bas et il n'est pas impossible que DESCARTES en ait entendu parler.

25. **Adrien Romain.** ROMAIN (Adrien) ou ADRIAAN VAN ROOMEN. *Biographie nationale* 19 (1907) col. 848-889.

Article de première main pour la description des ouvrages mathématiques. L'auteur a travaillé sur les exemplaires actuellement détruits ayant fait partie de la bibliothèque d'A. ROMAIN. Outre le cod 196 mentionné précédemment (cfr n° 21) l'auteur signale l'existence d'un volume autographe, le cod 253 de Louvain, dont il ne donne malheureusement pas le contenu.

26. Jean Stade. STADE (Jean) *Biographie nationale* 23 (1924) col. 526-533.

STADE, de Loenhout (Belgique), mathématicien et astronome, professeur à Louvain et au collège de France.

27. Simon Stevin. Notes sur l'arithmétique de SIMON STEVIN. *Ann. soc. scient.* 35 (1911) mém. p. 293-313.

1° Résolution de l'équation du 2^e degré dans l'arithmétique de S. STEVIN. L'auteur complète les détails donnés par TROPFKE sur le sujet.

2° A propos de CANTOR, Vorl. 2^e éd. t. 2, p. 573. Dans l'édition de GIRARD des œuvres de STEVIN, « il faut attribuer à GIRARD les passages, voire les traités entiers précédés de son nom, mais absolument rien d'autre. »

28. Simon Stevin. Sur quelques exemples de la méthode des limites chez S. STEVIN. *Ann. soc. scient.* 37 (1913) mém. 171-199.

29. Simon Stevin. Le calcul infinitésimal chez SIMON STEVIN. *Mathesis* 37 (1923) tiré à part : pp. 18 in 8°.

Ces deux articles se complètent : STEVIN dans son *Beghinselen der Weeghconst* 1586, et dans son *Beghinselen des Waterwichts* 1586, a perfectionné la méthode d'ARCHIMÈDE pour le calcul du centre de gravité, en y introduisant le passage à la limite. CANTOR date de 1608 l'introduction du procédé. G. DE SAINT-VINCENT a profité de l'idée de STEVIN.

30. Simon Stevin. La Thiende de SIMON STEVIN. A propos d'un exemplaire de l'édition originale qui a échappé à l'incendie de Louvain. *Rev. quest. scient.* 27 (1920) p. 109-139.

[L'ouvrage était en lecture en Août 1914]. STEVIN y expose deux idées originales : 1° Les fractions décimales (déjà utilisées avant lui) peuvent servir dans toutes les opérations arithmétiques. 2° On devrait adopter un système décimal de poids, mesures et monnaies, qu'il décrit.

31. Simon Stevin. La Thiende de SIMON STEVIN. Facsimile de l'édition originale plantinienne de 1585. Avec une introduction par H. BOSMANS (*Editions de la société des bibliophiles anversois* n° 38) Anvers 1924 pp. 41 + 37 in 8°.

Il y a quatre exemplaires connus de cette édition. L'appendice algébrique a complètement disparu depuis l'incendie de Louvain. L'auteur analyse la « thiede » en citant d'après le texte français dû à STEVIN lui-même, pour faciliter la lecture de l'original flamand.

32. **Simon Stevin.** STEVIN (Simon) *Biographie nationale* 23 (1924) col. 887-938.

L'auteur résume ses travaux sur STEVIN. Ajoute des renseignements de première main sur les ouvrages auxquels il n'a pas encore consacré d'articles.

33. **Simon Stevin.** Remarques sur l'arithmétique de SIMON STEVIN. *Mathesis* 36 (1922) tiré à part : pp. 23 in 8.

34. **Simon Stevin.** La résolution de l'équation du 4^e degré chez SIMON STEVIN. *Mathesis* 39 (1925) p. 49-55 + 99-104 + 146-153.

Ces deux articles s'enchaînent et constituent un travail d'ensemble sur la résolution des équations chez STEVIN [voir pour l'équation du 3^e degré l'étude sur l'Invention nouvelle de GIRARD (n° 13)]. L'art. n° 33 reprend en partie le mémoire sur l'arithmétique de STEVIN (n° 28) et commence par une note sur la thiende (n° 30-31) l'article n° 34 finit par une conclusion générale des travaux de l'auteur sur STEVIN.

35. **Simon Stevin.** Le mathématicien belge SIMON STEVIN de Bruges (1548-1620). *Periodico di matematiche*. ser. IV 6 (1926) p. 231-262.

Résumé des travaux de l'auteur sur S. STEVIN.

- 35bis. **Taisnier (Jean)** (1508-15 ?) *Biographie Nationale* (1928)
[œuvre posthume dont nous n'avons vu que les épreuves en placards]

TAISNIER, grand oncle du peintre David Teniers I et arrière grand oncle de David Teniers II. Maître de chapelle de Charles-Quint, compositeur, poète, médecin, professeur de langues, astronome, mathématicien, chiromancien, physiognomiste et astrologue. L'auteur esquisse sa carrière mouvementée, et analyse brièvement ses opuscules imprimés. Les œuvres musicales sont perdues. Les œuvres scientifiques, les pseudo-sciences mises à part, sont de bons manuels scolaires.

36. **Tycho Brahe.** La trigonométrie de TYCHO BRAHE. *Rev. Quest. scient.* 20 (1901) p. 585-601.

37. **van Ceulen.** Une émule de VIÈTE : LUDOLF VAN CEULEN. Analyse de son traité du cercle. *Ann. soc. scient.* 34 (1910) mém. 88-139.

La traduction latine faite par SNELLIUS ressemble fort peu à l'original. L'auteur fait l'analyse de l'original.

38. **Philippe van Lansberge.** PHIL. VAN LANSBERGE de Gand (1561-1632) *Mathesis* (1928) p. 5-9.

Complète l'article de DE WAARD dans *Nieuwe nederduitsche biografische woordenboek*. Brève analyse des œuvres mathématiques de VAN LANSBERGE. Ministre protestant, partisan de COPERNIC, VAN LANSBERGE, avait avec ses confrères des difficultés qui en font un Galilée au petit pied. Attaqué aussi par LIBERT FROIDMONT de Louvain; défendu par son fils JACQUES. Pour

apprécier PHILIPPE VAN LANSBERGE, il ne faut pas oublier que NEWTON n'avait pas encore paru.

XVII^e Siècle.

A. — *Les missionnaires Jésuites en Chine.*

39. **Albert Dorville.** (1621-1662) Documents sur A. DORVILLE de Bruxelles, missionnaire S. J. au XVII^e siècle, et notamment sur les épisodes de son voyage vers Lisbonne et la Chine. *Analectes pour servir à l'histoire ecclésiastique de la Belgique* (Louvain) 3^e S. 7 (1911) p. 329-383 + 470-497.

ALBERT LÉCOMTE, dit DE DORVILLE, ou DORVILLE (DORFELDER dans les ouvrages allemands), attaché à l'observatoire de Pékin. Pour éviter le long et dangereux voyage d'Europe en Chine par mer, les jésuites essaient de reconnaître une route par terre. Le P. GRUEBER réussit à établir la jonction Smyrne Pékin. Au retour, on lui adjoint DORVILLE, qui détermine la latitude de tous les points du voyage (pas la longitude, faute de chronomètre). Il traverse le Thibet et l'Himalaya. DORVILLE meurt à son arrivée à Agra (Inde). Documents inédits (sauf un, publié en traduction allemande en 1728) mais qui sont plus intéressants pour l'histoire des missions et de la colonisation en Extrême Orient, que pour l'histoire des sciences. Cette remarque s'applique à tous les documents que l'auteur a publiés dans les *Analectes*.

40. **Jean de Haynin** (1633-1682) La correspondance inédite du P. J. DE HAYNIN d'Ath, miss. S. J. en Chine au XVII^e s. *Analectes hist. eccl. Belg.* 3^e S. 4 (1908) p. 197-224.

On a sept lettres de DE HAYNIN. Deux sont publiées (IIAZART, Kerckelycke historie van de gheheelc werelt. Anvers s.d. p. 389-390; et GACHARD, Bibliothèques de Madrid et de l'Escurial. Bruxelles 1875. GACHARD écrit *de Aynim*). L'auteur édite les cinq autres, avec une notice biographique sur HAYNIN, et une note sur la dispute entre astronomes chinois, arabes, et européens. La première lettre donne des renseignements sur cette dispute et sur l'introduction des méthodes européennes en Chine.

41. **Jean Baptiste Maldonat** (1634-1699). Correspondance de J. B. MALDONADO de Mons. miss. belge au Siam et en Chine. *Anal. hist. eccl. Belg.* 3^e S. 6 (1910) p. 39-86 + 187-237.

Notice sur MALDONAT. PHAULKON, aventurier grec devenu ministre au Siam, demandait aux jésuites de lui envoyer des astronomes comme on l'avait fait pour la Chine (cfr lettre XIII p. 196 sqq). Détails très intéressants sur les débuts de la colonisation française.

- 41bis. **Jean Baptiste Maldonat.** A propos de l'état politique de la Chine au temps du P. VERBIEST. — Lettre de J. B. MALDONAT de Mons S. J., datée de Siam le 24 Avril 1675 et adressée à son frère NICAISE, chanoine de la métropole de Cambrai, renfermant des détails

sur l'état politique de la Chine à une époque de la vie de VERBIEST sur laquelle on est peu documenté. *Annales de la société d'Emulation de Bruges* 67 (1924) pp. 181-195.

42. **Mathieu Ricci.** (1552-1610) L'œuvre scientifique de M. RICCI S. J. *Rev. Quest. scient.* 3^e S. 29 (1921) p. 135-151.

[cfr l'édition des œuvres de M. RICCI par TACCHI VENTURI et VACCA. Macerata 1911 et 1913]. *Li Ma Tou* (cfr MIKAMI. The development of mathematics in China and Japan. Leipzig 1913 part 1 pp. 113-114) est M. RICCI. Histoire de la mappemonde chinoise. Exploration partie de Goa, qui rejoint l'expédition de secours envoyée de Pékin : elle établit que Cathay est la Chine et Cambalu, Pékin au 16^e siècle, et Nankin au temps de MARCO POLO. Traduction, avec l'aide de PAUL SIU et de LÉON LINGOZUON, des six premiers livres d'EUCLIDE (1607) de l'arithmétique de CLAVIUS (1614) et d'un traité des isopérimètres en 18 propositions, que l'auteur n'arrive pas à identifier (1). Amorce l'introduction à Pékin des missionnaires astronomes. L'auteur détermine quelle avait dû être la formation mathématique de RICCI.

43. **François de Rougemont** (1624-1676) Lettres inédites de F. DE ROUGEMONT, miss. belge S. J. en Chine. *Anal. hist. eccl. Belg.* 3^e S. 9 (1913) p. 21-54.

Quelques renseignements sur l'astronomie européenne en Chine.

44. **François de Rougemont.** Documents relatifs à la liturgie chinoise. Le mémoire de F. DE ROUGEMONT à JEAN PAUL OLIVA. *Analecta bollandiana.* 33 (1914) pp. 274-293.

Introduction. Texte latin, d'après un ms de la bibliothèque Victor Emmanuel à Rome.

45. **Antoine Thomas.** Lettre inédite d'ANTOINE THOMAS. *Missions belges de la Compagnie de Jésus* (1908) tiré à part pp. 18 in 8^o.

Voyage de Lisbonne aux Indes par le Cap.

46. **Antoine Thomas.** Lettre du P. ANTOINE THOMAS S. J. datée de Pékin le 8 Septembre 1688. *Archiv für die Geschichte der Naturwissenschaften und der Technik* 1 (1909) p. 36-42.

Au sujet de VERBIEST qui vient de mourir. L'enterrement que l'empereur lui fait faire. Premières observations d'éclipses après la mort de VERBIEST. Les missionnaires servent d'interprètes entre les russes et les chinois.

47. **Antoine Thomas.** L'œuvre scientifique d'ANTOINE THOMAS de

(1) cfr PAPPI Collectionis... quae supersunt, ed HULTSCH. Berlin 1875, livre 5 prop. 1 à 18, pp. 304 à 350 (?).

Namur S. J. (1644-1709) *Ann. soc. scient.* 44 (1924) mém. p. 169-208 + 46 (1926) mém. p. 154-181.

1° Analyse de la *Synopsis mathematica* 2 vols Douai 1685, où THOMAS rassemble les notions de mathématiques et d'astronomie indispensables au missionnaire en Chine.

2° Analyse des observations astronomiques du P. THOMAS en Indo Chine, publiées dans les *Mémoires de l'Académie des sciences* de Paris 7 (1729) et de leur critique par GOUYE. LA HIRE, CASSINI. Lettres de THOMAS à propos d'une éclipse de soleil qui lui permet, croit-il, de trouver plus exactement la position du nœud; et à propos d'observations d'éclipses des satellites de Jupiter. L'intérêt de toutes ces observations, pour les académiciens, résidait surtout dans les déterminations de longitudes qui s'en déduisaient.

3° Les missionnaires ont exécuté, de 1702 à 1718, une triangulation de tout l'empire chinois. Au cours des opérations, ils constatent, et finissent par admettre en 1710, une différence de 258 pieds chinois entre la longueur du 47° et celle du 41° degré du méridien. D'où ils concluent à la non sphéricité de la terre. Ce grand travail d'ensemble avait été précédé (en Novembre 1702) de la mesure d'un degré de méridien dans le but d'unifier les mesures de longueur chinoises : l'empereur KANG HI voulait avoir un « stade » égal au 1/200 de la longueur d'un degré de méridien. Texte latin et traduction française d'un rapport de THOMAS sur cette dernière mensuration.

(L'auteur préparait depuis 1922 l'article THOMAS de la *Biographie nationale*).

48. **Ferdinand Verbiest** (1623-1688). Sur une particularité de l'astronomie chinoise. *Ann. soc. scient.* 27 (1903) p. 122-125.

VERBIEST. *Astronomia europaea*. Dilingae 1678 pp. 17 et 18, affirme que les chinois avaient de temps immémorial, une division centésimale du degré et des heures. Si VERBIEST a fait adopter la division sexagésimale, c'est que ses tables étaient construites dans ce système, et qu'il y allait de sa liberté et de sa vie de ne pas se tromper dans ses calculs.

49. **Ferdinand Verbiest**. Documents relatifs à F. VERBIEST. Les lettres annuelles de la vice-province S. J. en Chine. Année 1669 par ADRIEN GRELON. *Annales de la société d'émulation de Bruges* 62 (1912) p. 15-61.

Epreuves que l'empereur impose aux astronomes chinois, arabes et européens, à la suite de quoi VERBIEST devient directeur de l'observatoire. Travaux des astronomes à Pékin. Extraits des lettres de ceux-ci.

50. **Ferdinand Verbiest**. F. VERBIEST, directeur de l'observatoire de Péking. *Rev. Quest. scient.* 3^e S. 21 (1912) p. 195-273 + 375-464.

Il est impossible de résumer ce mémoire, dont devra tenir compte tout qui veut parler de VERBIEST, et des sciences chinoises au XVII^e s. L'auteur esquisse la biographie de VERBIEST, puis examine en détails sa carrière scientifique; sa vie de missionnaire est passée sous silence. A la fin de la vie de SCHALL, mandarin et directeur de l'observatoire de Pékin, VERBIEST se trouve seul à soutenir une attaque dirigée en apparence contre l'astronomie européenne, en réalité contre les missions chrétiennes. Elle se termine par la déconfiture

des méthodes chinoises et arabes. Après la mort de SCHALL, VERBIEST recueille sa succession, ce qui l'amène, outre les travaux réguliers d'un observatoire comportant un personnel subalterne d'environ 150 à 200 employés, à entreprendre les choses les plus inattendues, comme de combiner des machines pour transporter des matériaux de construction, ou de réformer l'artillerie impériale. En 1678 il invente un char à vapeur, d'ailleurs minuscule. L'auteur publie de nombreuses pièces inédites. Il laisse de côté les écrits chinois.

51. **Ferdinand Verbiest.** Les écrits chinois de VERBIEST. *Rev. Quest. scient.* 3^e S. 24 (1913) p. 272-298.

Complément au précédent. Le R. P. VAN HÉE a étudié les écrits chinois de VERBIEST dans les *Mélanges publiés par la société d'émulation de Bruges* 1913. L'auteur résume ce travail pour compléter l'article n° 50. MIKAMI ne semble pas avoir étudié les originaux de VERBIEST.

52. **Ferdinand Verbiest.** Le problème des relations de VERBIEST avec la cour de Russie. *Ann. soc. ém. Bruges.* 63 (1913) p. 193-223 et 64 (1914) p. 98-101.

VERBIEST sert d'interprète entre les chinois et les russes. Essai d'obtenir le libre passage des missionnaires par la Sibérie. Lettre de VERBIEST à NICOLAS GRAILOVITCH SPATHAR MILESCO. (traduction française de la traduction russe).

53. **Ferdinand Verbiest.** La notice nécrologique de FERD. VERBIEST par son secrétaire ANT. THOMAS de Namur. *Ann. soc. ém. Bruges.* 64 (1914) p. 102-133.

Texte latin d'une brochure qui fut tirée à peu d'exemplaires et est devenue fort rare.

54. **Ferdinand Verbiest.** Sur les lettres manuscrites des PP. VERBIEST et THOMAS, analysées dans le catalogue n°. 455 de la librairie Maggs bros de Londres. *Ann. soc. scient.* 47 (1927) p. 14-19.

Collection de 120 lettres de missionnaires. Des doubles de ces lettres ont été envoyés au général des jésuites et l'auteur possède la photographie de certaines de ces copies. Le résumé du catalogue est fidèle. Le n° 1322 ne peut pas être de VERBIEST, puisqu'on y parle de VAN DER BEKEN (Van der Besz du catalogue, est une erreur de lecture). Les n°. 1304 et 1305 sont la copie de deux fragments d'une lettre de THOMAS à l'académie des sciences de Paris, et ne sont donc pas inédites.

B. — Jésuites mathématiciens en Europe.

55. **Jean Charles della Faille.** Le traité De centro gravitatis de J. C. DELLA FAILLE. *Ann. soc. scient.* 38 (1912) mém. p. 255-317.

Analyse détaillée du seul ouvrage de DELLA FAILLE qui ait été publié [Les tirés à part ont une préface de P. MANSION : il y émet sans la démontrer l'opinion que la méthode d'invention, restée inédite, de DELLA FAILLE, devait être celle de l'ἔφοδος d'ARCHIMÈDE].

56. **Jean Charles della Faille.** Le mathématicien anversois JEAN CHARLES DELLA FAILLE S. J. *Mathesis* 41 (1927) tirés à part : pp. 11 in 8.

Sources de la biographie. Esquisse de la biographie. Lettre de G. DE SAINT-VINCENT sur DELLA FAILLE.

57. **Gilles François de Gottignies.** La logistique de G. F. DE GOTTIGNIES. *Rev. Quest. scient.* 4^e S. 13 (1928) p. 215-244 (posthume).

DE GOTTIGNIES est le premier algébriste qui se soit affranchi des démonstrations géométriques.

58. **Théodore Moretus.** THÉODORE MORETUS S. J., mathématicien (1602-1667) d'après sa correspondance et ses manuscrits. *Le Compas d'or* (Anvers) 6 (1928) p. 57-163 (posthume).

MORETUS (Moerentorf) est le petit fils de l'imprimeur CHRISTOPHE PLANTIN. L'auteur réservait pour des revues de mathématiques l'analyse détaillée de ses œuvres. La correspondance de MORETUS avec ses cousins d'Anvers est celle d'un savant avec les chefs d'une des grandes imprimeries de la Renaissance. Elle apprendrait beaucoup sur les ouvrages de l'époque. [Ainsi l'on constate que l'*Opus geometricum ad mesolabium* de G. DE SAINT-VINCENT, Gand 1688, qu'on croyait complet, a été amputé de trois livres sur les conseils de MORETUS, parceque SAINT-VINCENT y revenait sur sa perpétuelle chimère, la quadrature du cercle].

59. **Jérôme Saccheri.** Le géomètre J. SACCHERI 1667-1733. *Rev. Quest. scient.* 4^e S. 7 (1925) p. 401-430.

Précurseur des géomètres non euclidiens. [Voir compléments à cet article dans le compte rendu de : G. SACCHERI's *Euclides vindicatus* éd. tr. G. B. HALSTED Chicago 1920 *rec. Rev. Quest. scient.* 4^e S. 8 (1925) p. 238-240].

60. **Grégoire de Saint-Vincent.** Deux lettres inédites de G. DE SAINT VINCENT, publiées avec des notes bibliographiques sur les œuvres de G. DE SAINT-VINCENT. (et) Les manuscrits de DELLA FAILLE. *Ann. soc. scient.* 26 (1902) mémoires p. 22 à 40.

1^o Lettre à R. HAPPART 12 Avr. 1655 sur la vie et les travaux de DELLA FAILLE.

2^o Lettre du 1 Mai 1655 sur le *Novum Almagestum* de RICCIOLI.

3^o Bibliographie des travaux de GRÉGOIRE DE SAINT-VINCENT.

4^o Liste des travaux inédits de DELLA FAILLE.

61. **Grégoire de Saint-Vincent.** Documents inédits sur GRÉGOIRE DE SAINT-VINCENT. *Ann. soc. scient.* 27 (1903) mémoires p. 21-43.

1^o Lettre à JACQUES VAN DER STRAETEN 23 juillet 1611.

2^o Deux lettres à MERSENNE 9 Mai 1646 et sans date. (communiquées par PAUL TANNERY.)

3^o Elogium P. GREGORII A SANCTO VINCENTE; obiit Gandavi. 27 Jan. 1667
Liste des œuvres de G. DE SAINT-VINCENT qui ont été publiées.

62. **Grégoire de Saint-Vincent.** Sur la vie de GRÉGOIRE DE SAINT-VINCENT. *Ann. soc. scient.* 34 (1910) p. 174.

Détails chronologiques glanés dans les correspondances du temps.

63. **Grégoire de Saint-Vincent.** SAINT-VINCENT (GRÉGOIRE DE) *Biographie nationale* 21 (1911-1913) col. 141-171.

L'auteur résume ses travaux antérieurs, et ajoute, col. 166, de nouveaux détails.

64. **Grégoire de Saint-Vincent.** Lettre inédite de CHRISTOPHE GRIENBERGER SUR GRÉGOIRE DE SAINT-VINCENT. *Ann. soc. ém. Bruges* 63 (1913) p. 41-50.

G. DE SAINT-VINCENT croyant avoir trouvé la quadrature du cercle, le général des jésuites fait examiner son travail par GRIENBERGER, qui fait venir SAINT-VINCENT à Rome, et est émerveillé de ses autres trouvailles, alors que celui-ci n'attache d'importance qu'à sa prétendue quadrature. GRIENBERGER demande qu'on ne confère pas à SAINT-VINCENT des charges qui l'empêcheraient d'étudier.

65. **Grégoire de Saint-Vincent.** Sur les thèses de statique de GRÉGOIRE DE SAINT-VINCENT. *Ann. soc. scient.* 44 (1924) p. 17.

Les thèses défendues en 1624 par VAN AELST au collège des jésuites de Louvain, montrent que SAINT-VINCENT connaissait la « Weeghconst » de S. STEVIN. Cette influence était impossible à démontrer, le traité de statique de SAINT-VINCENT ayant été détruit en 1631 dans le sac de Prague.

66. **Alphonse-Antoine de Sarasa** (1617-1667). SARASA A. A. *Biographie nationale* 21 (1911-1913) col 389-393.

Plus prédicateur que mathématicien, SARASA édite l'œuvre posthume de SAINT-VINCENT (voir MORETUS, n° 58), résoud une question de MERSENNE, et défend la quadrature du cercle de SAINT-VINCENT.

67. **André Tacquet.** Le jésuite mathématicien ANDRÉ TACQUET (1612-1660). *Le Compas d'or* 3 (1925) p. 63-87.

En général, on ne connaît de TACQUET que le savant, pas l'homme. Une lettre donne des renseignements sur sa personnalité. L'auteur la publie et ajoute une biographie complète.

68. **André Tacquet.** Note historique sur la forme singulière de certains raisonnements par réduction à l'absurde. *Sphinx-Œdipe*. (32 *Quai Cl. le Lorrain-Nancy*) sér. C. 20^e Année Août 1925.

En certains cas, si l'on fait l'hypothèse contradictoire de la thèse à démontrer, on finit par aboutir à cette thèse elle-même.

BRUNSVICG et VAILATI attribuent au P. SACCHERI l'invention de cette forme de raisonnement. En réalité, EUCLIDE en fait usage (Elém., I. 9, prop. 12), CARDAN et CLAVIUS la connaissaient. En 1632, un élève de TACQUET l'ayant défendue, TACQUET se trouve attaqué par HUYGENS et VAN SCHOOTEN. HUYGENS prétendait que cette argumentation était valide, mais compliquait les choses inutilement. TACQUET en faisait usage, même lorsqu'une preuve classique était tout indiquée.

69. **André Tacquet.** ANDRÉ TACQUET S. J. et son traité d'arithmétique théorique et pratique. *Isis* 9 (1927) p. 66-82.

Notice biographique. L'auteur insiste sur les thèses défendues par TACQUET et ses élèves, connues par des documents rares ou disparus. Analyse de l'arithmétique d'après les notes de l'auteur sur l'exemplaire détruit de Louvain (éd. 1656). TACQUET a le premier démontré les opérations arithmétiques. Il a publié la même année que WALLIS la formule de la somme des termes d'une progression géométrique décroissante.

70. **André Tacquet.** Sur un exemplaire de la première édition de l'*Arithmeticae theoria et praxis* d'ANDRÉ TACQUET. Lovanii Cyp. Cœnostenius 1656. *Ann. soc. scient.* 47 (1927) p. 39-42.

Complément au n° 69. Le petit séminaire de Saint-Trond (Belgique) possède un exemplaire de l'éd. de 1656. La seconde édition ne diffère de la première que par des corrections typographiques et par la suppression d'un appendice du P. DER KENNIS sur la possibilité du nombre infini.

C. — *Autres mathématiciens.*

71. **Jean Bernoulli.** Sur une soutenance de thèses présidée à Groningue par JEAN BERNOULLI en 1701. *Revue des bibliothèques et archives de Belgique.* 2 (1904) p. 464-467.

Cette brochure de 16 pp. in 8°, conservée à la bibliothèque royale de Bruxelles (van Hulthem 20809) est omise par la bibliographie de BIERENS DE HAAN (*Bull. Boncompagni* 1881-1883) Le soutenant attribue au président des découvertes qu'il n'a pas faites. C'est conforme au caractère de BERNOULLI.

72. **Cavalieri.** Sur une contradiction reprochée à la théorie des indivisibles chez CAVALIERI. *Ann. soc. scient.* 42 (1920) p. 82-89.

CAVALIERI a dû voir qu'il y avait deux moyens de rendre la méthode des indivisibles rigoureuse : c'est d'y introduire la notion de fluxion (il emploie même le mot) ou bien de dire que la surface est comme une toile composée de fils extrêmement minces (la comparaison est de lui). Mais, dans son style embrouillé, il semble souvent mêler ces deux choses.

73. **Cavalieri.** Un chapitre de l'œuvre de CAVALIERI. *Mathesis* 36 (1922) p. 365-373 + 446-456.

Exercitatio quarta, prop. xvi-xxvii. CAVALIERI a vu nettement que
$$\int_0^a x^m dx = \frac{a^{m+1}}{m+1}.$$
 Mais il n'a pas remarqué que l'intégrale était

l'inverse du problème des dérivées et des tangentes. Malade, il jetait bien vite sur le papier des intuitions de génie, sans avoir le loisir de leur donner une forme définitive.

74. **Descartes.** L'auteur principal de l'« onwissen wiskonstenaer. J. STAMPIOENIUS ontdeekt door JACOBUS A WESSENAER ». Leyde 1640. *Rev. Quest. scient.* 4^e S. 11 (1927) p. 113-141.

C'est DESCARTES. ADAM et TANNERY l'ont déjà admis. La correspondance de HUYGENS fournit de nouveaux renseignements sur la question.

75. **Galilée.** La nouvelle édition des pièces du procès de GALILÉE par A. FAVARO. *Rev. Quest. scient.* 3^e S. 3 (1903) p. 578-598.

76. **Huygens.** GALILÉE ou HUYGENS. A propos d'un épisode de la première application du pendule aux horloges. *Rev. Quest. scient.* 3^e S. 22 (1912) p. 573-586.

Une lettre de HUYGENS à PIEK montre HUYGENS attaquant en contrefaçon l'horloger Douw qui fabriquait des horloges à balancier. L'invention de HUYGENS ne réside pas dans la substitution du pendule au balancier, mais dans un dispositif faisant décrire une cycloïde au pendule.

77. **Huygens.** Sur un point de l'histoire du calcul des probabilités (PASCAL et HUYGENS). *Ann. soc. scient.* 43 (1923) p. 318-326.

HUYGENS sur les jeux de hasard, est indépendant de PASCAL et de FERMAT, et, par conséquent, est un des créateurs du calcul des probabilités.

78. **Oughtred.** La première édition de la clavis mathematica d'OUGH-TRED. Son influence sur la géométrie de DESCARTES. *Ann. soc. scient.* 35 (1911) mémoires p. 24-78.

Faute d'avoir consulté l'édition de 1631 de la clavis, les historiens antidentent plusieurs découvertes d'OUGH-TRED. DESCARTES a connu tout au moins la substance de la clavis éd. 1631 et en a tiré parti.

79. **Pascal.** Note historique sur le triangle arithmétique de PASCAL. *Ann. soc. scient.* 31 (1906) p. 65-71.

La disposition du triangle arithmétique évolue d'une façon continue depuis STIFEL jusque PASCAL. Ce qui est personnel à PASCAL, c'est l'usage qu'il fait du triangle.

80. **Pascal.** Sur l'interprétation géométrique donnée par PASCAL à l'espace à quatre dimensions. *Ann. soc. scient.* 42 (1920) p. 337-345.

Dans les opuscules sur le problème de la roulette, PASCAL est acculé à faire intervenir un espace à quatre dimensions. Il s'en tire parfaitement, sans prétendre donner une théorie générale.

81. **Pascal.** PASCAL et les premières pages de « l'histoire de la roulette », *Archives de Philosophie* 1 (1923) tiré à part pp. 23 in 8°.

PASCAL n'a pas raconté exactement l'histoire de la roulette. L'auteur remet plusieurs détails au point : TORRICELLI n'est pas un plagiaire. MERSENNE n'a pas joué le rôle que PASCAL lui attribue. DE WAARD a déjà montré que le problème se rattache au paradoxe de la roue d'ARISTOTE. L'informateur de PASCAL n'était pas ROBERVAL. Était-ce DESARGUES ? Il faudra attendre la publication des lettres de ROBERVAL et de MERSENNE pour être fixé.

82. **Pascal.** La notion des indivisibles chez BLAISE PASCAL. *Archivio di storia della scienza* 4 (1923) p. 369-379.

Dans le traité de la sommation des puissances semblables des termes d'une progression, annexé au triangle arithmétique, PASCAL a les mêmes notions flottantes que CAVALIERI sur les indivisibles (voir Cavalieri n° 72.) Dans la lettre de DETTONVILLE à CARCAVI (problème de la roulette), PASCAL cite TACQUET. Ce dernier, tout en reconnaissant ce qu'il doit à CAVALIERI, a débrouillé la notion des indivisibles. PASCAL en profite, et à partir du traité de la roulette, il a une idée nette de ce qu'il appelle « la somme des ordonnées ».

83. **Pascal.** PASCAL et son traité du triangle arithmétique. *Mathesis* 37 (1923) p. 455-464.

Transcription du traité en notations modernes.

84. **Pascal.** Sur l'œuvre mathématique de B. PASCAL. *Rev. Quest. scient.* 4^e S. 5 (1924) p. 136-160 + 424-450.

J. BERTRAND dans son *Pascal*, Paris 1891, répond en partie à la question de SAINTE-BEUVE : quelle est exactement la valeur de PASCAL mathématicien ? Personne n'ayant répondu en l'année jubilaire 1923, l'auteur analyse les œuvres de PASCAL et conclut : Comme géomètre, il n'éclipse pas ses contemporains. Les titres de gloire du mathématicien PASCAL sont la théorie des nombres et le calcul des probabilités.

85. **Willibrord Snellius** (1581-1626) Le degré du méridien terrestre mesuré par la distance des parallèles de Berg op Zoom et de Malines. *Ann. soc. scient.* 24 (1900) mémoires p. 111-132. [cfr *Intermédiaire des mathématiciens* 13 (1906) p. 122].

SNELLIUS a revu plusieurs fois son *Eratosthenes batavus* Leyde 1617. MUSSCHENBROEK *De magnitudine terræ* 1729 utilise dans la première partie une première révision, où manquent les calculs depuis Berg op Zoom jusqu'à Malines. Dans la seconde partie, il utilise une seconde révision, datant de 1622 et ayant pour point de départ une base mesurée sur des prairies glacées. L'auteur a retrouvé la seconde révision de la première partie. SNELLIUS l'a inscrite en marge d'un exemplaire de l'édition de 1617 conservé à la bibliothèque royale de Bruxelles. L'auteur édite et commente ces annotations.

86. **Henri Stevin** (1614- ?) *Biographie nationale* 23 (1924) col. 884-887.

Fils de SIMON. Son œuvre fait connaître plusieurs idées de son père.

87. **Jean Trenchant.** Note sur l'arithmétique de JEAN TRENCHANT *Ann. soc. scient.* 33 (1909) p. 184-192 (seuls les tirés à part ont un titre).

TRENCHANT est le premier à publier des tables d'intérêt. STEVIN reconnaît la priorité de TRENCHANT dans des passages que GIRARD a omis. L'auteur donne la traduction de ces passages. TRENCHANT parle aussi du triangle arithmétique.

88. **Luc Valerio.** Les démonstrations pour l'analyse infinitésimale chez LUC VALERIO. *Ann. soc. scient.* 37 (1913) p. 211-228.

VALERIO n'a pas connu STEVIN. Il a dû influencer SAINT-VINCENT : l'exemplaire des centres de gravité de VALERIO éd. 1604 qui se trouvait à la bibliothèque de l'université de Louvain, a été entre les mains de SAINT-VINCENT. L'auteur complète les renseignements donnés par WALLNER sur VALERIO dans *Bibliotheca mathematica* 4 (1903) p. 246-259.

89. **van Langren.** La sélénographie de VAN LANGREN par WISLICENUS. *Rev. Quest. scient.* 4 (1903) p. 18-23.

Ce que WISLICENUS décrit sous le nom d'exemplaire de Bruxelles de la carte de VAN LANGREN est un calque exécuté assez récemment pour l'observatoire de Bruxelles.

90. **van Langren.** Deux documents sur la profession de géomètre arpenteur dans les Pays Bas au XVII^e s. *Rev. Quest. scient.* 4 (1903) p. 23-26.

En 1618 les archiducs imposent un examen aux arpenteurs. En 1645 VAN LANGREN demande que cette épreuve soit subie devant le professeur royal de mathématiques à Louvain. Classé sans suite le 8 Mars 1645.

91. **van Langren.** La carte lunaire de VAN LANGREN conservée aux archives générales du royaume à Bruxelles. *Rev. Quest. scient.* 3^e S. 4 (1903) p. 108-139.

Pour déterminer la longitude, VAN LANGREN imagine d'observer les obscurcissements et illuminations des montagnes lunaires. D'où la nécessité de dresser une carte. Il existe de cette carte trois exemplaires. L'auteur donne une reproduction de celui de Bruxelles, qui est manuscrit et signé. Lettres d'ERYCIUS PUTEANUS à VAN LANGREN au sujet de la carte. Octroi de subsides en 1626 : le dossier montre que VAN LANGREN travaillait à cette question depuis 1621, bien que « La verdadera longitud por mar y tierra » soit de 1644, et la carte de Bruxelles, de peu antérieure à 1645.

92. **van Langren.** Sur l'apologie des ingénieurs COECKX, MERCKX, et JANSSENS (Bruxelles 1660) *Ann. soc. scient.* 28 (1904) p. 63-70. — cfr *Revue des bibl. et arch. de Belgique* 1 (1903) p. 287-291.

Réponse aux attaques de VAN LANGREN (publiées par BIERENS DE HAAN. *Verhandeligen Akad. Amsterdam* 1893).

93. **van Langren.** La carte lunaire de VAN LANGREN conservée à l'Université de Leyde. *Rev. Quest. scient.* 3^e s. 17 (1910) p. 248-264.

Reproduction de la carte, qui est gravée par VAN LANGREN lui-même. Nouvelles lettres d'ERYCIUS PUTEANUS sur le sujet.

94. **Wendelin.** Sur les papiers de l'astronome WENDELIN conservés aux archives générales du royaume à Bruxelles. *Ann. soc. scient.* 33 (1909) p. 74-92.

Description de trois liasses des archives de Bruxelles. L'ouvrage De diluvio n'est pas entièrement perdu, comme le pense SIMAR. [*Musée belge* 12 (1908) p. 257]. Il en reste 72 pages à la bibliothèque royale de Bruxelles.

XVIII^e Siècle.

95. Présentation de deux opuscules : 1^o Barometri et thermometri prognosticationes earumque causae utilitates ex duodennali observatione methodo mathematica digestae et eruditis lectoribus emendendae propositae. Gandavi 1716. — 2^o Slot op den mondte ende Bril op de neus voor den Auteur van de gebedelde « Academie » met naeme J. VAERMAN. Door AD. HAEGHEMAN en F. VAN DER MAELE. Tot Gendt 1721. *Ann. soc. scient.* 29 (1905) p. 134-139.

1^o Œuvre d'un jésuite anglais professeur en Belgique. 2^o Donne de curieux renseignements sur la profession de géomètre aux Pays-Bas.

96. **Euler.** Sur l'édition belge des œuvres d'EULER. *Bibliotheca mathematica* 3 F. 9 (1908) p. 177.

97. **Euler.** L'édition belge, en français, des œuvres d'EULER. *Ann. soc. scient.* 32 (1908) p. 175.

98. **Euler.** Sur une tentative d'édition des œuvres complètes d'EULER, faite à Bruxelles en 1839. *Ann. soc. scient.* 33 (1909) mémoires. 265-289.

Cinq volumes ont paru en 1839. Un grand nombre de mémoires, qui ne représentent que le dixième de l'œuvre, se trouvent à la bibliothèque de l'observatoire d'Uccle. Dans le premier article, l'auteur souligne les nombreuses mutilations que l'œuvre d'EULER aurait subies, si l'impression n'avait pas été arrêtée.

XIX^e Siècle.

99. Notice sur les travaux de PAUL TANNERY. *Rev. Quest. scient.* 3^e S. 7 (1905) p. 544-574.

100. **Pierre Duhem.** Notice sur ses travaux relatifs à l'histoire des

sciences. *Rev. Quest. scient.* 3^e S. 30 (1921) p. 30-62 + 427-447.

101. Antonio Favaro (1847-1922). *Rev. Quest. scient.* 4^e S. 4 (1923) p. 156-175.

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ERRATA ET ADDENDA

Les notes du P. BOSMANS ont été déposées à la bibliothèque des Bollandistes à Bruxelles.

Les notices sur CAVALIERI (n^{os} 72 et 73) auraient dû être placées avant la n^o 55.

Notes sur quelques médecins juifs égyptiens qui se sont illustrés à l'époque arabe ⁽¹⁾.

Excellence, Mesdames et Messieurs,

Permettez moi, tout d'abord, de solliciter votre indulgence pour les imperfections de ma conférence, tant au point de vue de la forme que du fond. Veuillez considérer en effet, qu'il n'existe, jusqu'à présent, aucune histoire d'ensemble des médecins juifs en Orient, que leurs nombreux ouvrages sont en grande partie perdus, et que ceux qui peuvent exister dans les bibliothèques sont en grande partie inédits et difficilement accessibles (2). Il est navrant de constater que les ouvrages médicaux les plus importants d'ISAAC ISRAELI, et de MAIMONIDE, n'ont pas été publiés en langue arabe quoiqu'il en existe des traductions latines et hébraïques depuis le moyen-âge, et quoique des ouvrages médicaux arabes beaucoup moins importants aient été imprimés depuis longtemps. Les biographies mêmes d'un très grand nombre de célèbres médecins juifs de l'époque arabe restent éparpillées dans les ouvrages des historiens et bibliographes musulmans. Sauf STEINSCHNEIDER (3), les rabbins KRONER et MUENZ ont eu

(1) Conférence faite à la *Société d'Etudes Historiques Juives d'Egypte*, au Caire, le 31 mai 1928.

(2) Le petit manuel de MUENZ, en langue allemande a ses mérites, mais est trop sommaire pour être considéré comme une histoire d'ensemble.

(3) MORITZ STEINSCHNEIDER (1816-1907), le savant hébraïste et arabisant de Berlin, a recueilli, depuis 1840, tous les matériaux nécessaires pour écrire une histoire documentée des médecins juifs. Il n'a malheureusement pas pu accomplir sa tâche, et après sa mort, on a dressé simplement une liste de 2168 médecins juifs (*Die juedischen Aerzte*. Frankfurt a.M. 1914-15). Il a laissé beaucoup de ses matériaux concernant les savants et les médecins juifs dans deux ouvrages bibliographiques de la plus grande importance : *Die hebraeischen Uebersetzungen des Mittelalters*. Berlin 1893, et *Die arabische Literatur der Juden*. Frankfurt a.M.

seuls l'idée de mettre au jour l'histoire des médecins juifs en orient. Devant ce vaste matériel inédit dont l'étude demanderait toute une vie humaine, j'ai dû me borner à évoquer sommairement quelques traits caractéristiques de la science médicale des plus célèbres d'entre eux, et négliger la grande masse des moins réputés.

Avant d'aborder notre thème, jetons un regard sur l'état des sciences et particulièrement de la médecine à l'époque qui précède l'Islam. Le monde oriental avait été hellénisé par les conquêtes d'ALEXANDRE LE GRAND. Alexandrie devint le centre intellectuel de ce nouveau monde et cette situation ne fut point altérée plus tard par la domination romaine. Les Juifs eux-mêmes, comme vous le savez, furent complètement hellénisés en Egypte et dans la plupart des provinces asiatiques de l'empire des Séleucides. Il n'y avait que la Palestine et surtout Jérusalem qui formaient le centre de la résistance du judaïsme contre l'hellénisme, résistance qui s'est manifestée par de nombreuses révoltes des Juifs contre leurs oppresseurs, depuis les Séleucides jusqu'aux Byzantins. Cependant la pensée scientifique des Juifs restait grecque. N'est-ce pas le cas de PHILON et de FLAVIUS JOSEPH, l'historien? L'essor du christianisme et la conquête de l'Asie Centrale par les Perses n'ont pas eu d'influence marquée sur les sciences. La chimie et la géographie ont seules bénéficié d'un léger apport indien et persan. La philosophie restait sur les lignes tracées par PLATON et ARISTOTE, la médecine suivait les doctrines d'HIPPOCRATE et de GALIEN et la mathématique celles d'EUCLIDE et de PTOLÉMÉE. La langue grecque régnait toujours à Alexandrie; mais en Syrie, en Asie Mineure, en Mésopotamie, la langue néo-aramaïque ou syriaque commençait à devenir la langue scientifique, et peu à peu des médecins, surtout ceux appartenant à la secte chrétienne des Nestoriens, traduisaient les ouvrages des grands médecins grecs en syriaque. Au ^{ve} siècle ap. J. C. une école de médecine fut ajoutée à l'académie de Gondé-Châpour (en Khouzistan) en Perse, qui avait été fondée un siècle plus tôt par les rois sassanides. C'est là que se rencontraient les doctrines des Grecs, traduites en syriaque et en pهلévi (perse moyen)

1902 (en anglais, London 1901). En plus, I. MUENZ a écrit une courte histoire des médecins juifs du Moyen-Age (*Die juedischen Aerzte im Mittelalter*, (2^e éd.) Frankfurt a.M. 1922. Quant à KRONER voir la bibliographie à la note 29.

avec celles des médecins indiens apportées par des missions spéciales et traduites du sanscrit en perse. Notons, en passant, que la connaissance du jeu d'échecs fut transférée, de cette façon, au VI^e siècle, des Indes à la cour du roi KHOSRAU ANOÛCHIRVÂN, par l'intermédiaire de son médecin particulier BORZAWAÏH ou BARZOÛYA qui était peut-être Juif.

Pendant toute cette période, l'histoire passe sous silence les médecins juifs qui, cependant, ont dû exister et même être appréciés, puisque JEAN CHRYSOSTOME, le Père de l'Église et patriarche de Constantinople au IV^e siècle, dit occasionnellement qu'il est préférable de mourir que de se faire soigner par un médecin hébreu ! Les trois académies juives en Perse, à Soura, Poumbeditha et Nchardea s'occupaient uniquement d'exégèse biblique et de traditions, en négligeant la médecine ; mais le Talmud lui-même, dont les origines peuvent être situées entre les II^e et VI^e siècles de l'ère chrétienne, contient beaucoup de matériel médical, et mentionne quelques médecins, surtout le babylonien MÂP SAMUËL (165-257 ap. J. C.) dont les sentences sont fréquemment citées dans le texte (4).

Après les débuts du prophète MAHOMET et la conquête des pays africains et asiatiques gouvernés par les Byzantins et les Perses, nous apprenons d'abord qu'un médecin du nom de THÉODOCÉUS attaché à la personne du puissant vizir HADDJÂDJ IBN YOÛSOUF († 714 ap. J. C.) aurait répandu la connaissance de la médecine hellénique dans l'empire des Omayyades et qu'il aurait eu un élève juif du nom de FORÂT BEN CHAHNÂTHÂ. Ce dernier était médecin de 'ÎSÂ IBN MOÛSA, gouverneur de Koufa après l'avènement de la dynastie des Abbasides (à partir de 750) (5).

Les bibliographes arabes nous ont encore transmis deux noms de médecins juifs qui ont vécu à Basra au VIII^e siècle. Ce sont les Persans MÂSARDJÏS ou MÂSARDJAWAÏH et son fils 'ÎSÂ. MÂSARDJAWAÏH s'est rendu célèbre surtout par la traduction arabe d'un grand ouvrage médical grec, des *Pandectes* d'AHARÔN d'Ale-

(4) Voir I. PREUSS, *Biblich-talmudische Medizin*. Berlin 1911.

M. NEUBURGER, *Geschichte der Medizin*. Stuttgart 1911. vol. II, pp. 80-88.

GEORGE SARTON, *Introduction to the History of Science*. vol. I Baltimore 1927. (Le deuxième volume contiendra entre autres choses un résumé de la science hébraïque du XII^e au XV^e siècle).

(5) IBN AL-QIFÎ, *Kitâb al-Ilukamâ*, ed. I. LIPPERT. Leipzig 1903.

L. LECLERC, *Histoire de la Médecine Arabe*. Paris 1876, vol. I, p. 82.

xandrie (première moitié du VII^e siècle), livre qui avait été préalablement traduit du grec en syriaque par un certain GESSIUS. Ces faits vous donnent une idée du mélange de races et de langues qui régnait au début de l'Islam : le prêtre chrétien AHARÔN, portant un nom sémitique, écrit en langue grecque ; le grec GESSIUS traduit en syriaque et le juif persan MASARDJÏS en arabe ! MASARDJÏS a, du reste, écrit des ouvrages médicaux indépendants ; mais tous sont perdus, de même que sa traduction des *Pandectes* aharoniennes. Le célèbre médecin arabo-persan RAZÈS (AR-RÂZÎ) lui fait l'honneur de le citer fréquemment sous le simple nom d'AL-YAHOUDÎ (le Juif) (6), surtout lorsqu'il parle de son traité *Sur les Vertus des Drogues*.

Nous ne savons pas grand chose du développement des sciences sous le règne des califes ommayyades (661-750). Les califes abbassides (à partir de 750), comme nous l'avons dit, avaient commencé d'acheter et de faire traduire systématiquement tous les manuscrits grecs de médecine, de philosophie et de sciences naturelles, dans toute la vaste étendue de leur empire et même dans les provinces voisines de l'empire byzantin. AL-MA'MOÛN fonda en 830, à Bagdad une académie bibliothèque appelée *Maison de la Sagesse* (*Baït al-Hikma*) où il entretenait à ses frais un grand nombre de traducteurs. La plupart d'entre eux étaient médecins, et presque tous Chrétiens nestoriens connaissant les langues grecque, syriaque et arabe. Ainsi furent traduits, sous AL-MA'MOÛN et ses dix successeurs, jusqu'à la fin du IX^e siècle, à peu près tous les ouvrages d'HIPPOCRATE, GALIEN, RUFUS, DIOSCORIDE, ORIBASE, PAUL D'ÉGINE et d'autres, ceux des philosophes grecs et de leurs commentateurs, ceux des mathématiciens, astronomes, géographes, chimistes et botanistes. Voilà la source de ce merveilleux essor de la médecine arabe, essor auquel les médecins juifs ont largement contribué. Si nous suivons IBN ABÎ OÏAÏBÎ'A le fameux historien des médecins de langue arabe (7) nous rencontrons aux IX^e siècle à peu près 130 médecins Chrétiens, 3 païens (Sabiens, i.e. adorateurs d'étoiles), 3 Juifs et 5 Musulmans ;

(6) LECLERC, *l.c.* pp. 77-81.

(7) IBN ABÎ OÏAÏBÎ'A, 'Oyoûn al-anbâ fî ïabaqât al-aïibbâ'. Le Caire 1882, 2 vols. (arabe).

M. STEINSCHNEIDER, *Zeitschr. d. Deutschen Morgenlaend. Gesellsch.*, 53, 428-34, 1899.

au x^e siècle 29 Chrétiens, 4 Païens, 6 Juifs et 30 Musulmans, au xi^e siècle 4 Chrétiens seulement, contre 7 Juifs et une grande majorité de Musulmans. Les chroniqueurs arabes nous parlent de deux médecins célèbres, prétendus Juifs persans, qui ont vécu au ix^e siècle. Ce sont SAHL IBN BICHR appelé RABBAN AṬ-ṬABARÎ et son fils 'ALÎ, connu par son encyclopédie médicale *Firdaous al-Ḥikma* (Paradis de la Sagesse) qu'il a composée vers 850 ap. J. C. (8). Mais ils étaient Chrétiens nestoriens convertis à l'islamisme. Cela ressort d'un ouvrage récemment découvert et publié à la bibliothèque de Manchester (9). Cet ouvrage est un traité apologétique de la religion musulmane écrit par 'ALÎ AṬ-ṬABARÎ. C'est pourquoi dorénavant il faut cesser de les considérer comme médecins juifs de langue arabe.

Les sources hébraïques nous ont transmis les noms de deux médecins juifs qui ont vécu à Bagdad vers 800 de l'ère chrétienne. L'un est ISHÂQ IBN 'IMRÂN l'ainé, l'autre JOSUÉ BEN NOÛN. Ce dernier aurait été le professeur du grand médecin, philosophe et astronome musulman ABOÛ YOÛSOUF YA'QOÛB IBN ISHÂQ AL-KINDÎ(10). Mais d'autres sources le désignent comme un Chrétien.

Passons à présent au plus célèbre médecin juif après MAIMONIDE, à ISAAC BEN SALOMON ISRAELI, appelé par les Arabes ABOU YA'QOÛB ISHÂQ IBN SOLAÏMÂN AL-ISRÂ'ÎLÎ. Né au ix^e siècle, il serait mort centenaire (vers l'an 932). « ISHÂQ IBN SOLAÏMÂN AL-ISRÂ'ÎLÎ, dit SILVESTRE DE SACY (11) dans sa traduction, fut un médecin habile, de grand talent et très instruit. Il se rendit célèbre par son génie et ses connaissances, composa d'excellents ouvrages, et se distingua par la noblesse de ses sentiments... c'est lui qu'on connaît communément sous le nom d'Al-Isrâ'Îlî. Il était natif de l'Égypte

(8) IBN ABÎ OṢAÏBĪ'A, *l.c.*, vol. I, p. 308-9.

IBN AL-QIFTĪ, *l.c.*, p. 231.

IBN AN-NADĪM, *Kitâb al-Fihrist*, ed. FLUEGEL, Leipzig 1871, vol. I, p. 296.

STEINSCHNEIDER, *Zeitschrift d. Dtsch. Morgenl. Gesellsch.*, 54, 46-48, 1900.

H. SUTER, *Die Mathematiker und Astronomen der Araber*. Leipzig 1900, pp. 14-15.

E. G. BROWNE, *Arabian Medicine*, Oxford 1921, pp. 37-44.

(9) 'ALÎ ṬABARÎ, *The Book of Religion and Empire*, ed. A. MINGANA. Manchester 1923 (texte arabe; la traduction anglaise, parue en 1922, n'est pas à ma disposition).

(10) *The Jewish Encyclopedia*, vol. VIII, 1906, p. 414.

(11) SILVESTRE DE SACY, *Relation de l'Égypte par 'ABD-ALLATIF*, médecin arabe de Bagdad, Paris 1810, pp. 41-45.

et se livra d'abord à l'exercice de la profession d'oculiste. Ensuite il vint s'établir à Kairawân, et s'attacha à ISHÂQ IBN 'IMRÂN (le Jeune, un remarquable praticien musulman), dont il devint le disciple. Il fut attaché comme médecin à l'imâm ABOÛ MOHAMMAD 'ABDALLAH AL-MAHDÎ, souverain de l'Afrique. (c'est ZIYÂDAT-ALLÂH III de la dynastie des Aghlabites, 903 à 909 ap. J.C.) Jamais il ne contracta mariage, et ne laissa point d'enfants. Quelqu'un lui demandant un jour, s'il ne serait pas bien aise d'en avoir : Nullement, répondit-il, puisque..... je laisse quatre ouvrages qui conserveront ma mémoire mieux que ne le feraient des enfants : le *Traité des Fièvres*, celui des *Aliments et des Remèdes*, celui de l'*Urine*, et enfin le *Traité des Eléments*. » IBN AL-DJAZZÂR, le plus célèbre disciple d'ISHÂQ nous a laissé le récit suivant qu'il tenait de la propre bouche du maître : « Lorsque je me rendis d'Égypte, disait ISHÂQ, auprès de l'émir ZIYÂDAT-ALLÂH fils d'AGHLAB, je le trouvai campé avec ses troupes à al-Orbos (à l'ouest de Kairawân), et j'allai l'y trouver. C'était lui qui m'avait fait venir, et m'avait envoyé cinq cents dinars (pièces d'or) pour frais de mon voyage. Dès qu'il fut instruit de mon arrivée je fus introduit auprès de lui, et je le saluai avec tout le respect dû à un prince. Mais je m'aperçus qu'il régnait peu de dignité à sa cour, et qu'il préférait le badinage et tout ce qui était propre à faire rire ». Un courtisan lui tendit de suite un piège en lui posant le dilemme suivant : ce qui est salé est agréable au goût, ce qui est doux est agréable, donc être doux c'est être salé et être salé c'est être doux ! ISHÂQ se tira d'affaire par une explication scientifique et à son tour posa la question suivante à son interlocuteur : « Ne prétendez-vous pas être vivant ? Sans doute, répondit-il. Ce chien dit ISHÂQ, est-il vivant ? Il l'affirma pareillement. Donc, lui dis-je, vous êtes ce chien et ce chien est vous ? » Sur ce, ZIYÂDAT-ALLÂH éclata de rire, et ISHÂQ reconnut qu'il aimait mieux les plaisanteries que les choses sérieuses.

En 909, ZIYÂDAT-ALLÂH fut vaincu et détrôné par le Fatimide AL MAHDÎ dont la dynastie conquiert plus tard l'Égypte. ISHÂQ IBN SOLAÏMÂN fut attaché à lui et à ses successeurs. Si cette dernière version donnée par plusieurs historiens est vraie, il ne serait pas mort en 932, mais au moins vingt ans après ; car il aurait soigné encore le troisième souverain fatimide de Tunisie AL-MAHDÎ jusqu'à sa mort qui eut lieu en 952 ap. J. C. Ceci s'accorderait

avec la longévité extraordinaire d'ISHÂQ dont parle IBN ABÎ OŞAÏBÎ'A.

Ce même auteur attribue à ISHÂQ, outre les quatre ouvrages médicaux mentionnés plus haut, une *Introduction à la Médecine*, un *Traité du Pouls*, un autre *de la Thériaque*, et plusieurs ouvrages philosophiques. Un dernier, *de l'Hydropisie*, n'est pas mentionné par les chroniques, mais se trouve en traduction hébraïque à Paris. Les œuvres médicales d'ISHÂQ sont écrites en arabe, parce qu'elles étaient dédiées aux souverains de Tunisie. Les traités *de la Fièvre* et *des Urines* étaient surtout très appréciés comme étant les meilleurs ouvrages de leur genre. Ils reflètent la médecine hellénique passée par le canal des traductions arabes du IX^e siècle. Trois des ouvrages existent en arabe.

Déjà au XI^e siècle, CONSTANTIN L'AFRICAIN, un renégat maure de Carthage, plus tard moine au couvent de Monte Cassino en Italie, a traduit les œuvres complètes d'ISHÂQ en Latin. Elles ont été imprimées à Lyon en 1515 sous le titre de *Opera Omnia Isaaci (Filii Salomonis)*. Leur influence sur la médecine de cette époque a été énorme. 'ALÎ IBN RIDWÂN, médecin égyptien musulman du XI^e siècle, dit du *Traité des Fièvres* : « Je déclare que ce livre est très utile, et que c'est l'ouvrage d'un homme d'un rare mérite. J'ai mis en pratique la plupart des choses prescrites dans ce livre et je n'ai rien trouvé à y ajouter ». IBN ABÎ OŞAÏBÎ'A ajoute : « cet ouvrage est supérieur à tout ce qui a été composé sur cette matière ». D'autres traductions latines de certaines œuvres d'ISAAC furent faites par GERARD DE CREMONE (+ 1187), le plus éminent traducteur arabo-latin du moyen-âge.

Tous les ouvrages d'ISAAC y compris quelques traités philosophiques ont été traduits plus tard en hébreu, en partie de l'original arabe, en partie du latin. Il existe, en plus, plusieurs traités uniquement en hébreu dont les originaux arabes sont perdus, p.e. un petit *Traité de l'Esprit et de l'Âme* (*Séfer ha-Rouah weha-Néfeh*) et un commentaire de la *Yeşîra*, le « Livre de la Création ».

En 1861, MOÏSE SOAVE a découvert un petit traité en hébreu, attribué à ISAAC ISRAELI (12), portant le titre « *Exhortation des Médecins* (*Moûşar le-Rôpheîm*) (13). C'est un recueil de cinquante

(12) Ce traité est dû, peut-être, à un autre ISAAC ISRAELI, Juif espagnol du XI^e ou XII^e siècle, qui écrit en hébreu.

(13) SOAVE; Guida dei medici, *Giorn. di Scienze Mediche*, vol. 18, 1861.

D. KAUFFMANN, ISAAK ISRAELI's Propaedeutik fuer Aerzte. *Magaz. f. Wiss. d. Judentums*, 11, 97-112, 1885.

aphorismes qui sont en partie très bien formulés. Je citerai parmi les maximes d'ISAAC : « Il est plus important de prévenir que de guérir ». « La plupart des malades guérissent par l'aide de la nature ». « Si tu as le choix de guérir par les aliments ou par les remèdes, choisis les premiers ». « Ferme ta bouche aux prédictions apodictiques et borne tes paroles aux présomptions ». « Ne prête pas ta langue à condamner ce qui est arrivé à un autre médecin, car chacun a ses heures de défaillance. Fais de telle façon que tu sois exalté par tes succès, et ne cherche pas ton bonheur dans l'ignominie des autres ». « Prends à cœur le traitement et la guérison des malades pauvres ; tu ne peux pas accomplir œuvre plus méritoire que celle-ci ». « Tranquillise le malade, même si c'est contraire à ta conviction, puisque tu aides ainsi la nature ».

Et parmi ses règles pratiques pour le médecin, je citerai la suivante : « Demande tes honoraires au malade à l'époque où sa maladie est encore violente ; car, une fois guéri, il n'oubliera que trop vite tes services rendus ! »

Les œuvres philosophiques d'ISAAC, le livre des Définitions et celui des Eléments, n'étaient pas appréciées, et MAIMONIDE lui-même, dans une lettre adressée à SAMUEL BEN TIBBON dit qu'ISAAC n'était qu'un éminent médecin, mais pas un philosophe de valeur.

Nous disions, plus haut, que le plus célèbre disciple d'ISHÂQ BEN SOLAÏMÂN était le musulman IBN AL-DJAZZÂR. Un autre élève du maître était ABOÛ SAHL DOÛNACH IBN TAMÎM, juif connu aussi sous le nom d'ADÔNÎM. Il succéda à ISAAC comme médecin à la cour des califes fatimides à Kairawân, où il composa plusieurs ouvrages de philosophie, de mathématique et de médecine, et a été en correspondance avec son fameux coréligionnaire et collègue HASDAÏ BEN CHAPROÛ (+ 970) ministre et médecin à la cour du souverain de Cordoue en Espagne. Il m'est impossible de m'occuper au cours de cette conférence des médecins juifs d'Espagne, mais je vous rappelle le fait que HASDAÏ a eu un immense mérite scientifique en traduisant du grec en arabe avec l'aide du moine NICOLAS, vers 951, la pharmacologie de DIOSCORIDE. Cet exemplaire avait été envoyé comme un cadeau diplomatique de l'empereur byzantin CONSTANTIN VII au calife 'ABD AR-RAH-MÂN III de Cordoue.

En parlant des traductions d'ouvrages médicaux dues à des

Juifs, je ne peux passer sous silence celles des plus vastes encyclopédies médicales du moyen-âge. Ce sont le *Kitâb al-Hâouy* (le *Continent, ou la science entière*) de RHAZÈS et le *Canon de la Médecine* d'AVICENNE, deux brillants médecins musulmans persans (x^e et xi^e siècle). Le *Continent* ne comprend pas moins de vingt cinq volumes manuscrits. Il n'en existe pas un seul manuscrit arabe complet, et le moins défectueux qui se trouve à la bibliothèque de l'Escorial (près Madrid), est dû au labeur de médecins juifs, car il porte en marge de nombreuses notes en hébreu. Pendant plus de quatre siècles personne n'avait osé traduire cet ouvrage gigantesque quand le Juif FARADJ IBN SÂLIM (SALOMON) appelé FARRAGUTH, originaire d'Agrigente (Girgenti en Sicile) entreprit cette tâche surhumaine, aux frais de CHARLES D'ANJOU, frère de LOUIS IX, roi de Naples. En 1279, il finit sa traduction latine qui fut imprimée deux siècles après à Brescia, en 1486. Elle remplit deux énormes volumes in-folio. LECLERC l'appelle la plus importante traduction pour l'histoire de la médecine, car le *Continent* rend compte de tous les ouvrages médicaux grecs et syriaques connus aux Arabes, en ajoutant les extraits des premiers livres de médecine arabe jusque vers 900 ap. J.-C.; FARRAGUTH a, en outre, traduit en latin deux autres ouvrages importants des médecins arabes chrétiens IBN DJAZLA et IBN BOÏLÂN (xi^e siècle de l'ère chrétienne).

Quant à l'autre encyclopédie médicale arabe, moins vaste, mais plus célèbre, le *Canon* d'AVICENNE, elle avait été traduite en latin par le Chrétien GÉRARD DE CRÉMONE. Elle a été traduite de l'arabe en hébreu par NATHAN IIA-MEÂTÎ, en 1279, à Rome, et en même temps par ZERAÏYA BEN ISAAC BEN CHÉALTIEL HEIN. Cette dernière traduction est incomplète. Celle de NATHAN a été corrigée et améliorée plus tard par JOSEPH BEN JOSUÉ LORKÎ. La première impression du *Canon* hébreu fut éditée en trois gros volumes à Naples, vers 1491, un siècle avant la première édition arabe (à Rome, 1593).

Passons à un médecin qui n'est connu que sous le nom d'ASAPH HA-YEHOÛDÎ (ASAF IUDAEUS) dont la vie est inconnue, mais qui doit être placée au ix^e ou x^e siècle. Son traité de médecine *Sêfer Rephoûôth* est le plus ancien connu en langue hébraïque (14),

(14) MORITZ STEINSCHNEIDER, Die hebraeischen Uebersetzungen des Mittelalters etc. Berlin 1893, pp. 388-402 et 754-761.

peut-être traduit du grec ou du syriaque puisqu'il ne cite que des livres médicaux grecs. Il contient l'anatomie, la physiologie, la pathologie, l'hygiène, la thérapeutique, et à la fin des aphorismes et le fameux serment d'HIPPOCRATE. Parmi les remèdes cités, il y en a plusieurs qui étaient inconnus à la médecine hellénique.

Vous avez remarqué sans doute, qu'il y avait au x^e siècle déjà toute une pléiade de médecins juifs célèbres, sans compter ceux qui doivent leur gloire plutôt à leur science philosophique ou philologique qu'à la médecine, comme p.c. YÔNÂ (IBN DJANNÂH), le grammairien et médecin hispano-juif de Saragosse.

Pendant les siècles suivants, du xi^e au xiv^e, le nombre des médecins juifs de langue arabe va en augmentant, et leur réputation aussi. Nous les trouvons comme médecins à la cour de beaucoup de souverains musulmans, à Séville, à Grenade, à Fès, au Caire, à Damas, à Alep, à Bagdad et même chez les sultans mongols, dans l'Asie Centrale. SA'D AD-DAOULA, vizir et médecin juif du sultan mongol ARGHOÛN, perdit la vie presque en même temps que son maître, en 1291 (15).

Je citerai quelques-uns du nombre, surtout ceux qui ont vécu en Égypte :

A la fin du x^e siècle vivait à la cour du calife fatimide AL MO'IZZ (952-75) le savant MÔCHÊ BEN ELEÂZÂR, auteur d'un traité de pharmacologie. Il est mort en 974 après avoir vu ses fils ISAAC et ISMA'ÎL et son petit fils JACOB admis comme médecins au service du calife et honorés par lui quoique restant israélites. Son frère, par contre, se convertit à l'Islam. (16). Au Caire il y avait au xi^e siècle un certain EPHRAÏM IBN ZÂFÂN (-| 1068) qui avait la passion des livres (17). Il possédait une bibliothèque énorme et entretenait continuellement des copistes pour les transcrire. Une fois, le vizir AL-FADL acheta de lui dix mille volumes. Malgré cela, EPHRAÏM laissa encore à sa mort plus de vingt mille manuscrits. A la même époque, le calife fatimide AL-HÂKIM BI-AMRI'LLÂH, malgré sa haine féroce contre les mécréants, avait dans son service un chirurgien juif du nom d'AL-HAQÎR AN-NÂFI' (18), c'est à

(15) RICH. GOTTHEIL, *The Jewish Encyclopedia* vol. II 1902, p. 162.

LUDWIG VENETIANER, *Asaf Iudaeus*, 3 fasc. Budapest 1915-7.

(16) IBN ABÎ OŞAÏBI'A, *l.c.*, vol. II. p. 86.

(17) *Ibid*, vol. II, p. 104.

(18) *Ibid*, vol. II., p. 89.

dire « l'Utile », titre honorifique donné par le calife. SALÂMA IBN RAḤMOÛN et son fils MOBÂRAK vivaient au Caire vers 1100. Le père était élève en médecine du bibliophile EPHRAÏM, dont je viens de parler, et élève en philosophie du bibliophile musulman AL-MOBACHIR IBN FÂTIQ. Il a écrit, entre autres, deux petits traités « Pourquoi la pluie est rare au Caire », et « Pourquoi les femmes du Caire engraisent quand elles commencent à vieillir » (19). HIBBAT-ALLÂH IBN ZEIN AD-DÎN avec le titre honorifique Chams ar Ri'âsa (le soleil de l'autorité religieuse), connu sous le surnom IBN DJAMÎ' AL-ISRÂ'ÎLÎ était un des médecins du sultan SALADIN (xii^e siècle). IBN ABÎ OṢAÏBÎ'A nous raconte (20) comment il gagna une réputation extraordinaire en sauvant la vie à quelqu'un atteint de mort apparente et que l'on portait au cimetière sur un brancard, par les rues du Caire. Il n'avait vu que les pieds du malheureux, mais avait observé qu'ils étaient dressés et non pas affaissés comme chez un cadavre. IBN DJAMÎ' a composé plusieurs traités de médecine en langue arabe. Quelques uns existent dans les bibliothèques de Paris et d'Oxford mais ne sont pas édités.

ABOU'L BAYÂN AS-SADÎD IBN AL-MODAWWAR, juif karaïte, était médecin à la cour des derniers califes fatimides (jusqu'en 1171), et à celle du grand SALADIN, leur successeur. Il est mort très âgé au Caire en 1183. Son ouvrage principal était *ad-Dostour al-Maristânî*, une pharmacopée à l'usage des hôpitaux. Mentionnons encore son contemporain ABOÛ'L FADÂ'IL IBN AN-NÂQID, oculiste juif au Caire, mort en 1188, connu par son aménité envers les malades pauvres (21). Son fils ABOÛ'L-FARADJ, également oculiste, embrassa la religion musulmane. IBN ABÎ OṢAÏBÎ'A énumère encore toute une série de médecins juifs égyptiens réputés, p.e. un autre HIBBAT-ALLÂH, mort en 1184, un certain MOWAFFIQ BEN CHAOU'A, chirurgien et oculiste (+ 1183), ensuite ABOU'L BARAKÂT IBN AL QODÂ'Î (+ 1202) qui était chirurgien et oculiste au service du sultan AL-'AZÎZ, fils et successeur de SALADIN. ABOÛ'L MA'ÂLÎ IBN T'AMMÂM, contemporain de MAIMONIDE, était médecin juif, attaché successivement à la cour de SALADIN

(19) LECLERC, *l.c.*, vol. I p. 533.

IBN ABÎ OṢAÏBÎ'A, vol. II, p. 106.

(20) vol. II, p. 112 suiv.

(21) *Ibid*, p. 116.

et à celle de son frère SAPHADIN (SAÏF AD-DÏN). (22) AS'AD AL-MAHALLÎ, né à Mahalla al-Koubrà (Basse-Égypte) était également un praticien estimé, et après lui DAVID BEN SALOMON (1161-1251), médecin à l'hôpital an-Nâsirî au Caire.

Il semblerait que la position des médecins juifs était des plus enviables; ceci est vrai pour certaines époques et pour certains souverains tolérants, comme p.e. SALADIN lui-même et ses successeurs. Mais en général, les médecins juifs ont souffert de la haine des musulmans et des chrétiens autant que leurs coréligionnaires, surtout pendant les croisades. Preuve, la conversion à l'islamisme d'un grand nombre de médecins juifs célèbres. Je ne mentionnerai que SAMUEL BEN YAHOUÛDA (SAMAOU'AL IBN YAḤYÂ), originaire de Fès (Maroc, XII^e siècle). Poussé par des persécutions religieuses, il émigra avec son père, et s'arrêta après de longues pérégrinations d'abord à Bagdad, et plus tard à Marâgha (Adherbaïdchân, Perse Septentrionale). C'est là qu'il se convertit à l'islamisme, vers 1163, pour se dérober aux persécutions de la clique hostile qui dominait à la cour des Atabegs d'Adherbaïdjân dont il était le médecin favori (23). Le rénégat le plus célèbre parmi les médecins juifs est probablement HIBBAT-ALLÂH IBN 'ALÎ IBN MALKÂ, qui porte les deux titres honorifiques d'ABOÛ'L BARAKÂT (père des bénédictions) et d'AOUḤAD AZ-ZAMÂN (l'unique de son temps) qui attestent la renommée dont il jouit (24). Son histoire est caractéristique de son époque, ce même XII^e siècle de l'ère chrétienne : HIBBAT-ALLÂH, né en Mésopotamie, vint à Bagdad aux fins d'étudier la médecine. Ici le plus célèbre professeur de cette ville, SA'ÏD IBN HIBBAT-ALLÂH, détestait les Juifs et ne les admettait pas à ses cours. Alors le jeune homme au moyen d'un *bakchiche* octroyé au concierge de l'académie, eut accès au corridor adjacent à la salle de lectures et put suivre de là en secret pendant un an le cours du maître. Plus tard, le jeune étudiant eut l'occasion de gagner la faveur du maître par une réponse intelligente, et dès lors SA'ÏD lui permit de suivre son cours comme les autres. Comme médecin, il gagna une grande réputation, et il finit par devenir médecin à la cour du calife AL-MOSTANDJID (1160-70) à Bagdad. Mais des attaques continuelles

(22) *Ibid*, p. 117.

(23) LECLERC, vol. II, p. 12-19.

(24) *Ibid*, p. 29-31.

et des signes de mépris de la part des courtisans le blessèrent profondément. On cite une épigramme dont le sens est : « Nous avons un médecin juif qui déploie un grand faste, et qui cependant n'est qu'un chien sorti du désert ». C'est pourquoi il se convertit à l'islamisme, après avoir obtenu du calife un décret en faveur de ses filles qui refusèrent de suivre l'exemple de leur père. Du reste, sa conversion ne lui a pas procuré le bien-être désiré, puisqu'il perdit son poste à cause d'une intrigue contre son collègue chrétien AMIN AD-DAOULA IBN AT-TALMÎDH, intrigue qui avait raté, et ABOU'L BARAKAT devint plus tard lépreux, sourd, et aveugle et mourut à l'âge de quatre-vingts ans. Il a composé lui-même son épitaphe : « ABOU'L BARAKÂT AOUHAD AZ ZAMÂN qui connut la bonne et la mauvaise fortune, et qui écrivit le *Mo'tabar* ». C'était son ouvrage le plus renommé, un traité de philosophie et de physique.

Plusieurs de ces médecins juifs convertis se sont laissés pousser à écrire des pamphlets contre la religion qu'ils avaient abandonnée. Le plus connu de ces écrits est dû au même SAMAOÛ'AL IBN YAHYÂ et est intitulé *Ifhâm tâ'ifat al-Yahoûd* (Pour faire taire la secte des Juifs); une copie manuscrite ancienne se trouve à la Bibliothèque Nationale du Caire.

La bibliographie des médecins juifs en Orient au XII^e siècle est inépuisable. Laissons de côté les médecins juifs des autres pays d'Orient et vivant en d'autres temps. Et pour finir, arrêtons nous un peu plus longuement à l'histoire des deux médecins les plus connus de l'Égypte moyennageuse : MAIMONIDE et KÔHÊN AL-'AṬṬÂR. Je me bornerai strictement à leur œuvre médicale, car l'œuvre philosophique de MAIMONIDE, ce grand penseur, appartient au monde entier.

MÔCHÊ BEN MAIMÔN (25) naquit à Cordoue en Espagne en 1135. Il dut quitter sa ville natale en 1149, un an après sa conquête par les Almohades, musulmans fanatiques venus du Maroc. Pendant des années il erra avec sa famille à travers l'Espagne, le Maroc, la Syrie et la Palestine, avant de trouver un gîte. Finalement il vint s'établir en Égypte, à Fostât (Vieux-Caire) vers 1167. MAIMONIDE a étudié probablement la médecine (en même temps

(25) I. GUTTMANN, MOSES BEN MAIMON. Frankfurt a.M. 2 vols. 1908-14.
I. MÜNZ, MOSES BEN MAIMON. (MAIMONIDES) Frankfurt a.M. 1912.

que la philosophie et la théologie juive) en Espagne, et plus tard à Fés (au Maroc) où sa famille était établie entre 1158 et 1165. Nous ignorons quels étaient ses professeurs. Sans doute, il n'aurait jamais exercé la profession de praticien si la mort précoce de son frère DAVID ne l'avait pas obligé à pourvoir seul aux besoins de sa nombreuse famille. Ainsi il dut en même temps s'occuper de sa charge de *Nâguid* (chef) de la communauté israhélite du Caire et soigner les sultans ayyoubides et leurs courtisans. MAIMONIDE raconte lui même, dans une lettre adressée à son élève JOSEPH BEN YEHOÛDA (26), comment il quittait sa demeure de Fostât au point du jour et allait à cheval à al-Qâhira (Le Caire), pour y faire antichambre au palais et pour visiter les nobles clients. Il regrette de ne pas soigner les malades pauvres, faute de temps.

Il n'est pas sans intérêt de voir MAIMONIDE jugé comme médecin par les plus éminents de ses contemporains musulmans. L'historien IBN AL QIŦÎ (+ 1248) (27) raconte d'abord comment MAIMONIDE fut admis parmi les médecins à la cour du dernier calife fatimide au Caire (AL-'ÂPID, + 1171); qu'on le choisit ensuite pour être envoyé chez le roi des Francs (croisés) à ASCALON, probablement AMAURY I^{er} de Jérusalem, qui avait demandé aux Musulmans l'envoi d'un médecin, mais que MAIMONIDE refusa d'accepter cet office. Après la chute des Fatimides (en 1171) le Qâḍi al-Fâḍil (juge suprême) 'ABD-AR-RAḤÎM IBN 'ALÎ AL-BAISÂNI prit MAIMONIDE à son service et lui fixa un salaire. IBN AL-QIŦÎ continue : « Il était associé aux médecins et ne se séparait pas d'eux dans ses opinions, quoiqu'il fut peu sociable; il n'était pas doux dans la prescription du traitement et du régime..... »

Le jugement d'IBN ABÎ OṢAÏBÎ'A, le plus grand historien des médecins arabes, est bien plus favorable (28) : Le chef (*ar-ra'îs*) ABOÛ 'IMRÂN MOÛSÂ IBN-MAIMOÛN de Cordoue, le Juif, était savant dans les traditions religieuses des Juifs et comptait parmi leurs savants docteurs; il était leur chef dans le pays d'Égypte. Il était unique en son temps dans la profession médicale et de sa pratique, doué de connaissances scientifiques, et particulièrement fort en philosophie. Le roi victorieux SALÂḤ AD-DÎN (SALA-

(26) MUNK, Notice sur JOSEPH BEN IEHOUDAH, *Journal Asiatique* 1842.

(27) *Tarih. al-Hukamâ'*, p. 318.

(28) *Oyoun al-Anbâ'*, vol. II p. 117.

DIN) l'estimait beaucoup et se servait de lui comme médecin. Ainsi fit AL-MALIK AL-AFDAL, son fils (NOUR AD-DÎN) 'ALÎ.

Nous avons enfin le récit d'ABD AL-LATÎF, médecin éminent de Bagdad qui visita l'Égypte vers 1200, et qui désirait faire la connaissance de MAIMONIDE; à cette époque c'était un vénérable vieillard de soixante cinq ans. ABD AL-LATÎF (29) dit : MOÏSE fils de MAÏMOUN vint me voir. Je reconnus en lui un homme d'un mérite supérieur, mais dominé par le désir de tenir le premier rang, et de faire sa cour aux personnages puissants. Il a composé un traité de médecine, dans lequel il a recueilli un choix des seize livres de GALIEN, et de cinq autres livres. Il s'est imposé la loi de ne rien changer aux expressions des ouvrages où il puisait, si ce n'est peut être une conjonction ou une particule, se contentant seulement de choisir les textes qu'il voulait faire entrer dans cet extrait ». Après cela, on serait amené à penser que MAIMONIDE n'était en médecine qu'un compilateur sans esprit ni jugement. Nous verrons de suite le contraire, lorsque nous examinerons le plus grand livre médical de MAIMONIDE, celui précisément dont parle 'ABD AL-LATÎF.

Ce sont les *Aphorismes* de MAIMONIDE (*foşouî Moûsâ*, en hébreu : *pirgê Môché* (30). Le Maître a composé cet ouvrage vers 1188, en langue arabe. En 1277 ZERAHYA BEN ISAAC BEN CHÉALTIEL HEIN à Rome en a donné une traduction hébraïque : NATAN HA-MEÂTI une autre peu de temps après. Cette dernière traduction a été imprimée, très mal du reste, à Lemberg (Pologne) en 1805 et à Wilna en 1888. Une traduction latine du texte arabe a été faite au moyen-âge, par un inconnu, et imprimée à Bologne en 1486. L'ouvrage original, en arabe, existe dans quelques bibliothèques à Constantinople, Madrid (Escorial), Leyde, Göttingen et Gotha. Le texte de la bibliothèque de Gotha (le N° 1937), acheté en Égypte au XVI^e siècle est un manuscrit de grande valeur, car il porte une note du copiste disant qu'il a été copié de la copie du neveu de MAIMONIDE, ABOU'L-MA'ÂLÎ YOUSOUF IBN 'ABD-ALLÂH; et ce dernier dit dans une autre note qu'il a fini sa copie en Août 1205, et que le maître n'a plus eu le temps d'en reviser

(29) DE SACY, Relation de l'Égypte par ABDALLATIF, Paris 1810, p. 466.

(30) I. PAGEL, MAIMUNI als medizinischer Schriftsteller. Dans MOSES BEN MAIMON, Frankfurt 1908. vol. I, p. 231 suiv.

la fin avant sa mort (qui eut lieu le 13 Décembre 1204) (31). Je vous ai fait remarquer, au début de cette conférence qu'il n'existe pas d'édition de ce plus grand ouvrage médical de MAIMONIDE dans le texte arabe original. Il me semble qu'il serait un devoir d'honneur pour les nombreuses sociétés qui s'occupent de l'histoire juive d'éditer cet ouvrage, les *Aphorismes* de MAIMONIDE.

Nous connaissons la substance de cet ouvrage d'après les traductions hébraïques et latines. MAIMONIDE dit au début qu'il l'a composé pour soi-même et pour les autres médecins, pour leur faciliter la connaissance de la vaste œuvre du médecin grec GALIEN. Il a fait un extrait en vingt-cinq chapitres comprenant plus de 1500 sentences médicales. Nous ne partageons aucunement l'opinion précitée d'ABD AL-LATÎF que c'est une compilation méticuleuse et dépourvue d'idées propres. Au contraire, MAIMONIDE ajoute de nombreuses remarques qui commencent par la formule stéréotype : *Moïse dit*. Le dernier (25^e) chapitre est remarquable; c'est là que MAIMONIDE critique les opinions de GALIEN qui, cependant, était l'autorité absolue pour tous les médecins du moyen-âge. MAIMONIDE indique plus de quarante matières où le célèbre Grec se trouve en contradiction avec ses propres paroles. Dans les dernières lignes du traité, MAIMONIDE réfute les opinions téléologiques de GALIEN quant à la genèse du monde et insiste sur la justesse de la cosmogonie biblique.

MAIMONIDE a composé encore huit autres ouvrages médicaux. Quatre sont imprimés en traduction latine et hébraïque depuis fort longtemps. Cinq ont été édités depuis peu, par le rabbin HERMAN KRONER, avec traductions allemandes et commentaires (32). Ce sont les premières éditions de traités médicaux de

(31) STEINSCHNEIDER, Die hebraeischen Uebersetzungen des Mittelalters. Berlin 1893, p. 766.

(32) H. KRONER, Ein Beitrag zur Geschichte der Medizin. Oberdorf-Bopfingen 1906 (Hygiène des rapports sexuels, texte hébreu).

Le même, Eine medizinische MAIMONIDES Handschrift aus Granada. Dans *Janus*, vol. 20. Leyde 1916, p. 203-247. (Texte arabe du même traité).

Le même, Die Haemorrhoiden in der Medizin des XII. und XIII. Jahrhunderts. *Ibidem* 1911, p. 411-456, 645-718. (Texte arabe des *Hémorrhoides*).

Le même, Fi tadhîr as-sihhat. *Ibidem* Leyde 1923-25. vol. 27, p. 101-116, 286-300, vol. 28, p. 61-74, 143-152, 199-217, 408-472, vol. 29, p. 235-258. (Texte arabe de l'Hygiène pour le sultan AL-AFDAL).

Le même, Der medizinische Schwanengesang des MAIMONIDES (*Fî bayân al-a'râd*). *Ibidem*, Leyde 1928, vol. 32 p. 12-116 (Consultation sur les causes des accidents du sultan al-Afdal, texte arabe).

MAIMONIDE publiées dans leurs textes originels. Je vous en parlerai peut-être dans une autre conférence.

Nous allons les énumérer, sans nous occuper de leur contenu. Ce sont : un livre *Sur les Poisons*, composé vers 1198 pour son protecteur, le QÂPI AL- FÂDIL, des traités sur *l'Asthme*, les *Hémorrhoïdes*, les *Rapports Sexuels*, *l'Hygiène*, des *Extraits des Œuvres de Galien*, un *Commentaire sur les Aphorismes d'Hippocrate*, et une *Consultation sur les Causes des Accès du Souverain de Raqqa* (le fils de SALADIN qui souffrait d'attaques de mélancolie). Il existe, en outre, toute une série d'ouvrages médicaux faussement attribués à MAIMONIDE, la plupart en hébreu.

Nous constatons, entre parenthèse, que MAIMONIDE, dans la préface de son *Commentaire des Aphorismes d'Hippocrate*, polémique encore contre GALIEN auquel il reproche sa verbosité et sa prolixité comme commentateur. Il promet, par contre, de commenter uniquement les endroits obscurs d'HIPPOCRATE et de faire tout son possible pour être bref (33).

L'influence des quelques ouvrages médicaux de MAIMONIDE qui avaient été traduits en latin a été considérable en Occident, et surtout en France. Nous trouvons de nombreuses citations des écrits du grand médecin-philosophe juif dans les œuvres des chirurgiens HENRI DE MONDEVILLE et GUY DE CHAULIAC (XIII^e et XIV^e siècle). Il va sans dire que MAIMONIDE se trouve souvent cité dans les ouvrages des médecins arabes après le XIII^e siècle.

Parmi les médecins disciples de MAIMONIDE nous ne mentionnerons que le plus connu JOSEPH BEN YEHOÛDA (IBN AKNÎN) natif de Ceuta (Maroc), mort en 1226 à Alep (34). Plusieurs des descendants directs de MAIMONIDE étaient des médecins estimés; ainsi son fils ABRAHAM (+ 1254), son petit fils DAVID (+ 1300) et les fils de ce dernier, ABRAHAM MAIMONIDE II (+ 1310) et SALOMON. Ce dernier était en même temps *Nâguid* d'Égypte (35).

Le Dr. KRONER se propose d'éditer les livres de *l'Asthme* et des *Poisons*.

(33) STEINSCHNEIDER, Die Vorrede des MAIMONIDES zu s. Comm. ueber die Aphorismen des HIPPOKRATES. *Zeitschr. d. Dtsch. Morgenlaend. Gesellsch.*, 48, 218 suiv., 1894.

(34) M. S. MUNK, Notice sur JOSEPH BEN ICHOUDAH ou ABOU'L HADJÂDJ YOUSOUF BEN YAÏYÂ AL-SABTÎ AL-MAGHRIBI. *Journal Asiatique* 1842.

STEINSCHNEIDER, JOSEF (IBN) AKNIN. Dans *Gesammelte Schriften*, Berlin 1925, p. 3 suiv.

(35) STEINSCHNEIDER, Zur Literatur des MAIMONIDEN. Breslau 1863 et 1901.

Au XIII^e siècle, il y avait en Égypte et surtout au Caire, encore toute une série de médecins juifs aussi bien rabbanites que karaïtes. Le temps me manque pour en parler.

Un dernier mot enfin au sujet d'un médecin juif égyptien dont les détails de la vie sont inconnus, mais dont l'unique ouvrage se trouve encore aujourd'hui entre les mains des droguistes indigènes de l'Orient arabe. C'est ABOÛ'L-MONÂ IBN ABÎ NAŞR IBN ẖAFFÂZ AL-HÂROÛNÎ AL-ISRÂ'ÎLÎ, plus connu sous le nom de KOHEN AL-'ATṬÂR (le droguiste) (32). Il a composé, en 1260, au Caire, un traité intitulé *Minhâdj ad Dokkân wa-Dostoûr al-A'yân* (Manuel de l'Officine et Norme pour les Notables). L'auteur dit qu'il a composé cet ouvrage en 658 de l'Hégire (1260 de l'ère chrétienne) pour son fils.

Il existe de nombreux manuscrits de cet ouvrage, dont nous trouvons la liste chez STEINSCHNEIDER (36). Le livre a été imprimé à Boulâq en 1287 (1870), au Caire en 1301 (1883), 1305 (1887), en 1330 (1912) et encore plusieurs fois jusqu'à nos jours. Les droguistes de l'Orient, comme nous l'avons dit, font grand cas de ce livre, ce qui est prouvé par les titres honorifiques qu'on donne à l'auteur dans les textes imprimés : *Aflâtoûn Zamânihi wa-Râ'is 'Awânihi* (Platon de son temps et chef de son époque). En effet, ce livre donne un résumé très complet des remèdes composés connus des Arabes, remèdes dont beaucoup nous ramènent à la médecine hellénique. L'ouvrage est divisé en vingt-cinq chapitres qui traitent de façon systématique les boissons, les confits, les opiat, les électuaires, les pilules, les collyres, les onguents, les cataplasmes etc. Dans le 23^e chapitre l'auteur donne des conseils professionnels aux pharmaciens; dans le 24^e, il traite de la récolte et de la conservation des simples; dans le 25^e, de l'épreuve des médicaments. C'est là qu'il indique les moyens pour reconnaître les sophistications. Parmi les ouvrages médicaux cités dans le texte nous trouvons ceux des Grecs GALIEN, PHILON, PAUL d'ÉGINE, des musulmans AR-RÂZÎ (RHAZÈS), IBN SÎNÂ, IBN RIDWÂN, IBN ROCHD (AVERROÈS) et IBN ZOHR (AVENZOAR); des Chrétiens AL-KINDÎ IBN MÂSAWÂH et IBN DJAZLA, et des Juifs AOUHAD AZ-ZAMÂN, IBN BAYÂN, IBN DJAMÎ, IBN AL-MO-

(36) STEINSCHNEIDER, Eine arabische Pharmakopie des XIII. Jahrhunderts *Zeitschr. d. Dtsch. Morgenl. Gesellsch.*, 56, 74-85, 1902.

DAWWAR, IBN RAḤMOÛN et ABOÛ'L-MA'ÂLÎ TAMMÂM, un contemporain et collègue de MAIMONIDE.

L. LECLERC, l'historien français des médecins arabes, appelle le *Minhâdj* « un des meilleurs (manuels) qui nous soient restés sur la matière, tant pour la forme que pour l'esprit suivant lequel il est composé ». (37) Et il conclut son article : « En somme le *Menhadj* est un des plus précieux monuments que la pharmacie nous ait légués ». Nous ajoutons que, si la valeur pratique de ce livre est de nos jours douteuse puisqu'il fournit les formules à la médecine populaire et aux empiriques, sa valeur historique est inappréciable.

Nous constatons que les médecins juifs de l'époque arabe ont souffert des persécutions infligées à tous les Juifs en Orient et en Occident. Mais d'autre part, ils ont gagné, par leur talent inné pour la médecine pratique, la faveur des souverains et des notables, ce qui leur a souvent permis d'adoucir le triste sort de leurs coreligionnaires. Mais leur rôle le plus important fut celui de servir de médiateurs scientifiques entre les peuples, entre l'Orient et l'Occident. HASDAÏ IBN CHAPROÛT a traduit la plus grande pharmacologie de l'antiquité du grec en arabe, et ceci avec l'aide d'un moine chrétien, pour un souverain musulman. Les œuvres d'ISAAC ISRAELI et de MAIMONIDE ont conquis l'Orient dans leur forme originale arabe, et l'Occident grâce à leur version latine. La pensée scientifique ne connaît ni ghetto, ni fanatisme !

Le Caire.

MAX MEYERHOFF.

(37) L. LECLERC, *Histoire de la Médecine Arabe*, vol. II, p. 215-17.

Notes on Indian Mathematics.

A criticism of George Rusby Kaye's interpretation.

The following lines occur in VINCENT SMITH's *The Early History of India* (3rd edition, 1914, page 305; 4th edition, 1924, revised by S. M. EDWARDES, pp. 322 & 323) :

« Mr. G. R. KAYE, a competent authority, holds that 'the period when mathematics flourished in India commenced about A.D. 400 and ended about A.D. 650, after which deterioration set in.' »

In his *A Short History of Mathematics* Dr. FLORIAN CAJORI writes that he has drawn heavily upon Mr. G. R. KAYE's *Indian Mathematics* (Calcutta, 1915) to write the chapter on Indian mathematics (1).

Dr. DAVID EUGENE SMITH and Sir THOMAS HEATH — two well-known historians of mathematics — have based some of their conclusions regarding Indian mathematics on the writings of Mr. G. R. KAYE.

Besides the late Messrs VINCENT SMITH and S. M. EDWARDES Sir RICHARD TEMPLE describes Mr. G. R. KAYE as an authority on Indian astronomy (2).

The above facts show in what light Mr. KAYE's writings have been accepted by foreign scholars, both European and American. Accordingly many erroneous conclusions, like the one contained in the quotation with which this paper opens, promulgated by

(1) Second edition, 1922, p. 84, foot-note.

This paper, *Indian Mathematics*, had been originally written for *Isis*, and the author had already read the proofs of it in April, 1914. Then publication was postponed by the war. The author became impatient and caused his paper to be reprinted and published independently (Calcutta 1915) with a few additions (articles 21 and 29, appendix 1, chronology, and index), but without any reference to *Isis*. The original paper appeared in *Isis* as soon as publication was resumed (vol. 2, 326-57, 1919). The following references to *Indian Mathematics* quote the pages of both the booklet and of *Isis* (Editor's Note).

(2) *Indian Antiquary*, Vol. 50 (February, 1921), p. 64.

Mr. KAYE regarding Indian mathematics and astronomy, have found a place in the works of foreign authors.

It may be stated at the outset that these foreign authors are not to blame for incorporating Mr. KAYE's conclusions in their works. Not being scholars of the Sanskrit language in which the works on Indian mathematics and astronomy were written, they had to depend on others for their knowledge of these subjects. Mr. G. R. KAYE's long residence in India as a high Government official, the association of his name with the English translations of ĀRYABHATA's *Gaṇitapāda* and ŚRĪDHARA's *Trīṣatikā*, his copious writings on Indian mathematics and astronomy, and his condemnation (3) of previous orientalists who held views contrary to his own, together with the fact that his opinions and statement of facts long went without sufficient challenge (4) from the Indians, naturally induced foreign scholars to regard him as a competent authority on Indian mathematics and astronomy and to reject the conclusions of the previous orientalists in favour of those held by him. Before an opinion which is hitherto generally accepted is allowed to be replaced by a new one, the latter ought to be subjected to a severe test. But, unfortunately for the cause of Science, Mr. KAYE's conclusions have been allowed to supersede or modify the current ones without sufficient scrutiny. The cause of the history of Science, therefore, demands a careful and thorough examination of his methods of investigation and conclusions.

There is not the shadow of a doubt that Mr. KAYE is an able writer and has the gift of presenting even a weak case in an apparently convincing form. Yet, the present writer feels that, instead

(3) Mr. KAYE writes that STRACHEY, BURGESS, and TAYLOR « are most unreliable » (*JRAS*, 1910, p. 756). Again he writes (*JRAS*, 1911, p. 812) : « BOMBELLI stated that DIOPHANTUS often quotes from Indian authors. Such misrepresentations are so obviously wrong that they are readily detected; but COSSALI, Sir WILLIAM JONES, PLAYFAIR, TAYLOR, COLEBROOKE, ROSEN, LIBRI, MAX MULLER, and others are no less culpable and often their statements are all the more dangerous by being somewhat less startlingly false. » The present writer will feel amply gratified if this paper serves to rescue the names of these departed savants from the unjust aspersions of Mr. G. R. KAYE.

(4) Mr. NALIN BIHARI MITRA's challenge published in the *Modern Review* (Calcutta) for July, August, and November, 1915 and also for June, 1916, does not seem to have reached foreign scholars of mathematics. Mr. N. K. MAZUMDAR's challenge published in the *Bulletin* of the Calcutta Mathematical Society, Vol. III (1911-12), does not seem to have produced any effect as yet.

of advancing the cause of Science, he has, by his writings, done considerable harm to it and that the history of mathematics and astronomy, at least so far as it relates to India, would have to be re-written.

If, as is alleged (5) by Mr. KAYE, « the tendency of the early orientalist was towards antedating » and they « were not always perfect in their methods of investigation », his own tendency has been towards postdating and his methods of investigation are open to serious objections. Consider the following instances taken from his *Indian Mathematics* :

(i) « *The word-symbol notation.* — A notation that became extraordinarily popular in India and is still in use was introduced about the ninth century, possibly from the East (6) » (page 31, lines 4-6; *Isis*, 2, 345).

(ii) « There is no sound evidence of the employment in India of a place-value system earlier than about the ninth century » (page 31, lines 28-30; *Isis*, 2, 346).

(iii) « The proof by 'casting out nines' occurs in no Indian work before the 12th century » (page 34, lines 8 & 9; *Isis*, 2, 348).

(iv) The earliest example of an alphabetic system of notation based on the place-value idea is of the twelfth century. (Page 31, lines 1-3; *Isis*, 2, 345).

(v) ÂRYABHATA's value of π « was not used by any other Indian mathematician before the 12th century » (pages 12 & 13). Again, « the Indians record an extremely accurate value (i. e., of π) at a very early date but seldom or never actually use it (page 32, lines 21-23; *Isis*, 2, 344, 346.)

A reference to VARÂHAMIHIRA's (died 587 A.D.) *Pañcasiddhântikâ* (Text edited by THIBAUT and DVIVEDI) and BRAHMAGUPTA's (born 598 A.D.) works will conclusively prove that the first (7) of the above statements is entirely wrong.

(5) *Indian Mathematics* (Calcutta), 1915, p. 1, *Isis*, 2, 326.

(6) Mr. KAYE omits to mention the name of the country from which the notation is alleged to have been introduced into India.

(7) The fact that Mr. KAYE could make this statement in spite of his supposed intimate acquaintance with the works of VARÂHAMIHIRA and BRAHMAGUPTA proves that he never cared to consult the original Sanskrit texts and that his only source of information was the English translation thereof. To attract the attention of foreign scholars to Sanskrit expressions for numbers in terms of word-numerals THIBAUT and DVIVEDI have got them printed in Devanâgarî numerals over the

The second statement is also equally wrong. Competent authorities like BURNELL, BURGESS, and BÜHLER are of the opinion that the numerous examples of the word-numeral notation that occur in the works of VARĀHAMĪHĪRA, BRAHMAGUPTA and their successors presuppose the previous existence of the modern place-value decimal notation. I have elsewhere (8) shown that the elder ĀRYABHAṬA (born 476 A.D.) has recorded a brief enunciation of the modern place-value decimal notation in the second verse of the second chapter of the *Āryabhaṭīyam*. The following passage occurs in the *Vyāsa Bhāṣya* (*Bibhūtipāda*, 13th *sūtra*) of the *Yogasūtra* of PATAÑJALI :

« Yathaikā rekhā śatasthāne śataṃ daśasthāne daśa ckañcaika-sthāne » (9) etc.

It may be translated thus :

« Just as the same stroke (or figure) represents a hundred, a ten, or a unit according as it is in the hundred's place, the ten's place, or the unit's place », etc.

Professor J. H. WOOD in this connection observes (10) that contrary to Mr. G. R. KAYE's opinion « the place system of decimals was known as early as the sixth century A.D. »

ŚAṆKARA's (c. 750) commentary on *Brahmasūtra* (i.e. *Vedānta-sūtra*) contains the following passage :

« Yathā caikāpi satī rekhā sthānānyatvena niveśyamānaikadaśaśatasahasrādipratyayabhedamanubhabati » etc. (*Śārīrikabhāṣya*, 2.2.17).

It may be translated thus :

« Just as the same stroke (or figure) conveys different ideas such as a unit, a ten, a hundred, a thousand, &c., according to the place in which it is set down », &c.

The use of such passages for the purpose of elucidation of abstruse philosophical doctrines shows that the place-value decimal notation was extremely popular at the time when the above commentaries were written. No authority has placed ŚAṆ-

number-expressions occurring on page 2 of the text of *Pañca-siddhāntikā*. Even these expressions do not seem to have been noticed by Mr. KAYE.

(8) *The American Mathematical Monthly* (October, 1927), pp. 409-15.

(9) My attention was kindly drawn to this passage and the next one by Dr. BIBHŪTIBHŪṢAN DATTA of the Calcutta University.

(10) Prof. J. H. WOOD's *English Translation of the Yoga System* of PATAÑJALI (Harvard Oriental Series). p. 216, foot-note.

KARA later than the latter half of the 8th century A.D. (*Encyclopædia of Religion and Ethics*, Vol. II. p. 185). Taking into consideration the absence of facilities of communication in those early times, it would not be extravagant to suppose that the decimal system of notation was at least two or three centuries old at the time of ŚAṆKARA. In no circumstances can the earliest date of the use of the modern place-value decimal system of notation in India be shifted to so late a period as the ninth century A.D.

The third statement also is untenable. The method of verification of the operations of multiplication, division, and extraction of square and cube roots by casting out nines (or more correctly, by repeated addition of digits) is given in the four concluding stanzas of the *Mahāsiddhānta* by the younger ÂRYABHAṬA who has been assigned to the middle of the tenth century by the late Mr. ŚAṆKARA BÂLAKRISHNA DIKSHIT (11) and also by Mr. R. SEWELL (12).

The younger ÂRYABHAṬA's *Mahāsiddhānta* will also disprove the fourth statement. This work practically opens with a statement of an alphabetic system of notation based on the place-value idea and contains numerous examples of this system.

The fifth statement has been commented upon by Dr. B. B. DATTA who has shown it to be wrong (13). The object of this statement is obviously to suggest the possibility of the value $\frac{62832}{20000}$ of π being given by the younger ÂRYABHAṬA. But the way in which the number 62832 has been expressed (namely, one hundred increased by four and then multiplied by eight, together with sixty-two thousand) shows that the author of the value cannot be the younger ÂRYABHAṬA or any other Indian mathematician who flourished after the middle of the sixth century A.D., since when, so far as our present knowledge goes, the method of expressing numbers in word-numeral notation based on the principle of place-value has come into use. The younger ÂRYABHAṬA uses his alphabetic (*kaṭapayādi*) system of notation in his *Mahāsiddhānta* with the exception of the chapter on Arithmetic where he uses the popular word-numeral notation except

(11) *History of Indian Astronomy*, (Poona, 1896), p. 231.

(12) *The Siddhāntas and the Indian Calendar*, (Calcutta, 1924), Preface, p. ix.

(13) See *Hindu Values of π* , *Journal of the Asiatic Society of Bengal*, New Series, 22, 39 & 40, 1926; see also pages 26 and 27.

in the cases of the four convenient numbers, 200, 250, 300, and 400. Hence, if the elder ÂRYABHATA had not been the author of the value of π under consideration, the complicated number which forms the numerator of the fractional value would have surely been expressed in the prevalent word-numeral notation. It might be stated here that the younger ÂRYABHATA gives the values $\sqrt{10}$ and $\frac{22}{7}$ of π and expresses the latter value in the current word-numeral notation.

Let us now examine Mr. G. R. KAYE's methods. The following examples will serve as illustrations :

(i) He almost correctly translates the elder ÂRYABHATA's principle of place-value as « each succeeding place is ten times the preceding » (14). Yet he states that « there is not in any part of ÂRYABHATA's work the remotest indication of a knowledge of a notation with 'place-values' » (15).

(ii) MUHAMMED BEN MUSA gives the value of π exactly in the unsimplified form previously given by the elder ÂRYABHATA alone and BRAHMAGUPTA's rules for finding the circumference of a circle and the diameters of two intersecting circles when the common chord and the sagittae of the resulting arcs are given, without trying to show how these rules and the value of π can be obtained. He also gives the elder ÂRYABHATA's rule for the area of a circle. Yet he observes that « it is absolutely certain that M. IBN MUSA did not copy his value of π from the Hindus » (16) and that « there is not the slightest resemblance between the previous Indian works and those of M. B. MUSA » (17).

(iii) BRAHMAGUPTA attempted to solve the so-called Pellian equation and was only partially successful. It is BHÂSKARA who completed the solution. Yet Mr. KAYE writes (18): « BHÂSKARA gives some alternative methods for the solution of the Pellian equation, but in no essential does he improve on BRAHMAGUPTA ».

The above three cases are assertions which Mr. KAYE does not attempt to substantiate. He feels bound to make the third assertion in order to support his preconceived notion that deterio-

(14) *JASB*, March, 1908, p. 117.

(15) *JASB*, July, 1907, p. 494.

(16) *JASB*, March, 1908, p. 122.

(17) *Indian Mathematics*, p. 42; *Isis*, 2, 354.

(18) *JASB*, 1910, p. 155.

ration in Indian mathematics took place before the time of BHÂSKARA.

(iv) In 1908 he published (19) a correct translation of ÂRYABHATA's rule, alleged to be the Greek rule *epanthema* in disguise. In 1915 he gave such a wrong translation of the same Indian rule as goes to show an apparent resemblance between ÂRYABHATA's rule and the Greek rule *epanthema* (20).

(v) To prove the alleged indebtedness of the Hindus to foreign sources he writes (21) : « BRAHMAGUPTA and BHÂSKARA distinctly indicate that they were compilers only, and frequent references are made by them to the 'text' and to 'ancient writers'. COLEBROOKE was misled into supposing that these ancient authorities were Hindus, but an examination of the references shews that the cases so referred to are just the cases that do not occur in earlier Hindu writings. »

The present writer believes that he has succeeded in showing elsewhere (22) that Mr. KAYE had never been at pains to undertake the examination of the references which he claims to have done.

(vi) To prove the alleged non-Indian origin of the modern arithmetical notation Mr. KAYE makes the following statement but does not give the reference :

« Sir RICHARD TEMPLE ... has shown us that the old ideas of notation still prevail, to a very great extent, among those in India who have not come in contact with foreign systems. This is practically the proof absolute that the new notation is not of Indian origin. » (23)

The statement attributed to Sir RICHARD TEMPLE appears to have been made by him with respect to Burma and not with respect to India (*Indian Antiquary*, 20, 53, 1891). On the other hand, he has distinctly stated that « a system corresponding to the European (*i.e.* the modern system of notation) has been in use among Hindus from a time long anterior to the era of British rule » (*ibid*). Sir RICHARD TEMPLE has also given the following reasons for the persistence of the old system :

(19) *JASB*, March, 1908, p. 133.

(20) *Indian Mathematics*, p. 47 (not in *Isis*). For details see the *Journal of the Bihar and Orissa Research Society* for March, 1926, pp. 88-91.

(21) *JRAS*, 1910, p. 759.

(22) *Bulletin of the Calcutta Mathematical Society*, 18, 69-76, 1927.

(23) *JASB*, July, 1907, p. 494.

- (a) It « is especially adapted to mental processes. »
- (b) It « demands the least mental exertion compatible with calculating at all ».
- (c) Under this system « it is not necessary to learn by rote to multiply beyond nine times nine ». (*Ibid*, p. 54).

But Mr. KAYE does not take these reasons into consideration in drawing an unwarranted conclusion.

(VII) Mr. KAYE writes : « ALBIRUNI tells us that BRAHMAGUPTA invented another system of notation generally designated by the term 'numerical words' » (*JASB*, July, 1907, p. 479). Let us compare this with the following statement of ALBIRUNI himself :

« BRAHMAGUPTA says : 'If you want to write *one*, express it by everything which is unique, as the *earth*, the *moon*; two by everything which is double, as, e. g. black and white;' (24) etc. (SACHAU's 'Translation of ALBIRUNI's, *India*, Vol. I, p. 177).

It will thus appear that ALBIRUNI never attributed the invention of the system of notation to BRAHMAGUPTA himself.

(VIII) To create a presumption against the Indian origin of the modern arithmetical notation in which the units increase from the right to the left Mr. KAYE states (25) that in India the smaller elements of a number used to be written first and refers his readers to the *Epigraphia Indica* as his authority. The following are some of the illustrations taken from that journal and altered to suit his purpose :

- (1) *Karabāṇaviśvaganīte* « i.e. reckoned by the hands (2), the arrow (50), and *visvas* (1300) or 1,352 (*Epigr. Ind.* v, 67) ». (*JASB*, July, 1907, p. 480).
- (2) *Vedavasvagnicandra* « i.e. *vedas* (4), *vasus* (80), fires (300), the moon (1,000) or 1,384 (*Epigr. Ind.* i, 94) » (*Ibid*).
- (3) *Yugakhendurūpa* « i.e. *yugas* (4), the sky (0), the moon (100), and the *rupa* (1,000) or 1,104 (*Epigr. Ind.* vi. 155) ». (*Ibid*).
- (4) « *Tatvaloke* ($t = 6, v = 40, l = 300, k = 1000$, i.e. 1346) (*Epigr. Ind.* III, 40) » (*Ibid*, p. 479).

(24) BRAHMAGUPTA's actual statement is as follows : « *Loke prasiddhasamjñā rūpādīnāṃ śaśāṅkādyāḥ* », or, 'The moon, etc., are the well-known names of one, etc.' (*Brahma-sphuṭa-siddhānta* edited by SUDHĀKAR DVIDEDI, Chap. XXIV, Verse 1).

(25) *JASB*, July, 1907, pp. 478 and 480.

- (5) « Râghavâya ($r = 2, gh = 40, v = 400, y = 1000$ i.e. 1442) (*Epigr. Ind.* vi. 112) » (*Ibid.*).

The writers in the *Epigraphia Indica* have actually used the words arrow, *viśva*, *vasu*, fire, moon and *rûpa*, and the Indian letters *v*, *l*, *k*, *gh*, and *y* in their accepted senses, namely, 5, 13, 8, 3, 1, 1, 4, 3, 1, 4, and 1 respectively and *not* as shown by Mr. KAYE. That Mr. KAYE has distorted the numerical significance of the word *moon* and of the letter *v* will appear even to a layman from the fact that the *moon* has been taken to signify both 1000 and 100 and *v* to signify both 40 and 400.

(ix) With the same object in view Mr. KAYE writes : « ÂRYA-BHATA's alphabetic notation differed from the Brahmi notation in having the smaller elements on the left. » (*Indian Mathematics*, p. 30; *Isis*, 2, 344).

He cites two examples which support his statement but he omits the expressions *dhuñvighva* ($= 140000 + 500 + 6000 + 4 + 60$) and *khricyubha* ($= 200 + 4000 + 60000 + 300000 + 24$) which do not support his view.

(x) To decry BRAHMAGUPTA Mr. KAYE writes : « A close examination of BRAHMAGUPTA's rules and examples establishes beyond all doubt that he was not their discoverer. He does not understand all the rules he gives. » (*JRAS*, 1910, p. 755).

It will appear from my paper *The source of the Indian solution of the so-called Pellian equation* (*Bulletin of the Calcutta Mathematical Society* for December, 1928) that Mr. KAYE either did not undertake a « close examination » of BRAHMAGUPTA's rules and examples or was quite unfit for the task.

(xi) In the mouth of a commentator Mr. KAYE puts the following remark regarding BRAHMAGUPTA :

« Having thus set forth the (solution of a) factum according to the doctrine of others, the author now delivers his own (incorrect) method with a censure on the other (correct method) » (*JASB*, March, 1908, p. 138).

Mr. KAYE has introduced the words 'incorrect' and 'correct method' only to cry down BRAHMAGUPTA. The commentator says nothing about the correctness or otherwise of the two methods (26).

(26) *Algebra with Arithmetic and Mensuration from the Sanscrit of Brahmagupta and Bhascara* by COLEBROOKE, p. 362, foot-note 1.

In fact, both the methods are correct. For details the reader is again referred to my article *The source of the Indian solution of the so-called Pellian equation*.

(XII) In his article *The Source of Hindu Mathematics* published in the *Journal of the Royal Asiatic Society* for the year 1910 Mr. KAYE, like an impartial investigator, begins well by laying down the following three criteria (p. 750) :

(1) « The evolution of mathematical ideas cannot proceed *per saltum*, but must proceed in an orderly manner ».

(2) « While mathematical systems of independent growth will naturally have many points of similarity, yet differences are certain to occur; it is, indeed, impossible for two systems to grow up independently in exactly the same manner. »

(3) « Priority of statement of a proposition does not necessarily imply its discovery. »

Then he adds : « How far the Hindu system of mathematics satisfies such criteria remains to be seen. » (p. 751).

Only a detailed examination of Hindu mathematical works can show how far the above three tests are satisfied by Hindu mathematics. Whenever such an examination has been undertaken, the theory of foreign origin has been exploded. But Mr. KAYE always prefers to undertake a brief (27) examination of Hindu mathematics, points out some accidental superficial similarities which must exist between the Hindu system and the foreign systems, and, contrary to the second criterion formulated by himself, has no doubt as to the certainty of foreign origin of Hindu mathematics. Let us see how cleverly he avoids applying the tests which he himself has laid down. He qualifies his previous remark by saying : « Possibly in a matter like this any definite conclusion that may be formed will depend upon accumulative evidence. This is difficult to deal with rigorously, and we can formulate no criterion that will help us here; but we may point out that in this respect the opinions of experts are particularly valuable » (p. 751). But Mr. KAYE attaches no value to those opinions of experts which differ from his own preconceived ideas.

The above cases will suffice to show that his methods of

(27) *JASB*, June, 1908, p. 293; *JRAS*, 1910, p. 750; *Indian Mathematics*, p. 23; art. 19; *Isis*, 2, 341; *East & West* (Simla), July, 1918, pp. 673, 675, 679.

investigation cannot lead to sound conclusions and that he can scarcely be regarded as a competent authority on Indian mathematics. His writings have been responsible for many erroneous conclusions in the history of mathematics. It is time that the attention of scholars were directed to these errors with a view to their removal from history.

Let us next consider Mr. G. R. KAYE's statement as to the time when deterioration in Indian mathematics began to set in. He regards the senior ÂRYABHATA as a plagiarist or a borrower from foreign sources and BRAHMAGUPTA and his successors as compilers only. He also suspects that «there never was a school of Hindu mathematicians» (*JASB*, July, 1907, p. 496). Assuming for the sake of argument only that he is right in his estimate of Hindu mathematicians, we fail to see why the period during which mathematics is supposed by him to have flourished in India should include the senior ÂRYABHATA and BRAHMAGUPTA only and exclude MAHÂVÎRA, the younger ÂRYABHATA, ŚRÎDHARA, PADMANÂBHA and BHÂSKARA. So far as arithmetic and algebra are concerned, the topics dealt with by the senior ÂRYABHATA and BRAHMAGUPTA in their known works are less numerous than those given by MAHÂVÎRA, the younger ÂRYABHATA, and BHÂSKARA whose treatment is fuller and clearer. Therefore, even if we accept his estimate of Indian mathematicians, we are bound to admit that, if arithmetic and algebra flourished at the time of the senior ÂRYABHATA and BRAHMAGUPTA, they certainly did not cease to do so before the death of BHÂSKARA. It has been shown (28) that his estimate of Indian mathematicians is not correct and rests on a serious misreading of facts. MAHÂVÎRA, the junior ÂRYABHATA, and BHÂSKARA have made considerable improvements on the previously existing method of solution of indeterminate equations of the first degree. MAHÂVÎRA is the first Indian mathematician to record (29) a rule for finding the L. C. M. of given numbers. He utilises it in finding the sum and difference of simple fractions and also in giving a general solution of his own of simultaneous linear indeterminate equations. He has dealt with a number of new series and distinguished

(28) See the present writer's articles in the *Bulletin of the Calcutta Mathematical Society*, Vols. 18 and 19.

29) *Gaṇita-sāra-saṃgraha*, Chapter III, §§ 55 & 56.

between the positive and negative square roots of a positive number. The method of verification of the arithmetical operations by repeated addition of digits (i. e. by casting out nines) and the treatment of indeterminate analysis, as given by the junior ÂRYA-BHATA, cannot surely be regarded as instances of deterioration. The fact that BHÂSKARA at the end of his *Vijaganita* acknowledges the algebraical works of BRAHMAGUPTA, ŚRÎDHARA, and PADMANÂBHA as his sources shows that ŚRÎDHARA and PADMANÂBHA were mathematicians of no mean merit. Unfortunately, these works of ŚRÎDHARA and PADMANÂBHA have not yet been recovered. BHÂSKARA's realisation of the true nature of the quotient of division by zero, his explanation of the method of false position, his admirable contribution to the theory of indeterminate analysis, both simple and quadratic, his anticipation of the modern idea regarding the convention of signs and of KEPLER's method of finding the surface and volume of a sphere by integration, and his important suggestion of the use of the letters of the Devanâgarî alphabet for unknown quantities in algebraic equations — which is the penultimate stage of what NESSELMANN calls Symbolic Algebra — cannot surely mark a period of deterioration.

Why, then, does Mr. KAYE fix 650 A.D. as the date when the period during which mathematics flourished in India ended in his opinion? In the Chronology given at the end of his *Indian Mathematics* he does not mention the name of any Indian mathematician or mathematical work between the years 150 B. C. and 476 A. D. Yet he includes the period A. D. 400 — 476 in the period of mathematical advancement in India. This fact makes his position all the more untenable.

In fixing the dates 400 A. D. and 650 A. D. he seems to have been guided, not by the actual state of mathematical knowledge in India but by a desire to establish his pet theory (subsequently recorded in his *Indian Mathematics* (30)) that India borrowed her entire mathematical knowledge from Greece and that the path of communication between the Indians and Greeks was by way of Persia. This theory requires that the period of mathematical advancement in India should fall within the Sâssânian period (A. D. 229-652) (31) in Persia. To show that this require-

(30) Pages 44 & 45.

(31) *Ibid.* Chronology given at the end.

ment is fulfilled he elsewhere (32) quotes (or rather, misrepresents) two authorities, namely, CHASLES and COLEBROOKE. He makes the following quotation from CHASLES :

« L'ouvrage de BHÂSKARA n'est qu'une imitation très-imparfaite (33) de celui de BRAHMAGUPTA, qui y est commenté et dénaturé..... Les propositions les plus importantes de BRAHMAGUPTA... y sont omises, ou énoncées comme inexactes Cette circonstance et les commentaires de différens scholiastes, nous paraissent prouver que, depuis BRAHMAGUPTA, les sciences, dans l'Inde, ont été en déclinant. »

This remark has been made by CHASLES, not with respect to the entire mathematical works of BHÂSKARA as Mr. KAYE wants his readers to believe but with regard to the geometrical portion of BHÂSKARA's works. The above extract has been taken from CHASLES' remarks on the Geometry of the Indians in his *Aperçu historique sur l'origine et le développement des Méthodes en Géométrie*, etc. The fact that BRAHMAGUPTA's important propositions on cyclic quadrilaterals find no place in subsequent Indian works has led CHASLES to conclude that the science of Geometry in India has been in decline after the time of BRAHMAGUPTA. Although BRAHMAGUPTA has made some very notable contributions to Geometry, this subject has never been the strong point of the Hindus. Except in a few cases Hindu Geometry was mainly experimental and intuitional (34). Hence, the Hindus never claim to have been great geometers. But they do claim to have been the greatest calculators on the strength of their achievements in the fields of arithmetic, algebra and trigonometry. Although attempts have been made to deprive them of the position they have been rightly enjoying, these attempts have made their position stronger than ever.

Mr. KAYE cites the authority of COLEBROOKE as follows :

« COLEBROOKE says that ARYABHATA was superior to any Hindu who came after him and that deterioration rather than advancement

(32) *JASB*, July, 1907, p. 496.

(33) This remark is not applicable to the arithmetical and algebraical works of BHÂSKARA.

(34) This goes to support the view that the Hindus were not aware, until at a much later date, of the demonstrative character of Greek geometry which, if known earlier, would have appealed readily to the speculative Hindu mind.

took place since the time of the more ancient author (p. 9) » (35).

Here also Mr. KAYE characteristically omits the subject of COLEBROOKE's remark so that the words 'deterioration' and 'advancement' may be made to apply to any branch of Hindu achievements. Let the reader compare the observation attributed to COLEBROOKE by Mr. KAYE with what the former actually states. COLEBROOKE writes : « ARYABHATTA appears to have had more correct notions of the true explanation of celestial phenomena than BRAHMAGUPTA himself; who in a few instances, correcting errors of his predecessor, but oftener deviating from that predecessor's juster views, has been followed by the herd of modern Hindu astronomers, in a system not improved, but deteriorated, since the time of the more ancient author. » (36)

Does COLEBROOKE here speak of deterioration in Hindu *mathematics*?

It will appear from the above that Mr. KAYE's opinion quoted by the late Mr. VINCENT SMITH regarding the period of mathematical advancement in India is not correct and that the period did not come to an end until after the death of BHÂSKARA.

Enough has been written to show that Mr. KAYE's views regarding Indian mathematics are erroneous. Some of his views on Indian astronomy have been challenged by Messrs. P. C. SEN GUPTA and S. R. DAS. The present writer is not competent to express any opinion on this subject. M. NAU's statement that the Indian figures were known in Syria in A. D. 662 has elicited from Mr. KAYE the observation that « his (NAU's) authority makes such erroneous statements about 'Indian' astronomy that we have no faith in what he says about other 'Indian' matters. » (*Indian Mathematics*, p. 31). In Mr. KAYE's own words one might similarly say, « Mr. KAYE makes such erroneous statements about Indian mathematics that we have no faith in what he says about other Indian matters. »

Cuttack, India.

SÂRADÂKÂNTA GÂNGULI.

(35) *JASB*, July, 1907, p. 496.

(36) *Dissertation*, p. ix.

Medallic Illustrations of the History of Science.

(*First Series : XIXth and XXth centuries*).

Fifth Article.

This collection of scientific medals began to appear in volume 8 of *Isis*. The fourth article appeared in volume 10, p. 485-8, pl. XII-XV, 1928. The Editor will welcome photographs or suggestions for the following parts of this series. It is intended to publish only medals having a sufficient scientific and artistic interest. Medals dedicated to scientists who are still living can not be published at once but will be considered for ulterior publication.

GEORGE SARTON.

No. 24. Sir JAMES DEWAR. British chemist and physicist. Born at Kincardine-on-Forth, Scotland, 1842; died, London, 1923. Spectroscopy. Liquefaction and solidification of « permanent » gases and connected problems. Vacuum jacketed vessels (idea of thermos bottles); etc.

Artist : ETHEL A. C. HARRIS. British sculptor and medallist, living in London (98 Gloucester Terrace, Hyde Park, W. 2). Photographs of 151 medals made by Lady HARRIS are published in : *Portrait medals of a generation modelled by ETHEL A. C. HARRIS*, with introductory note by G. F. HILL (134 p., 57 pl., London, SPINK and Son, 1928).

Date : 1908.

Size : 80 mm.

Collection : Sculptor's.

Obv. : Sir JAMES DEWAR. Fullerian professor of chemistry, Royal Institution, 1908. (fig. 33).

Rev. : None.

No. 25. Sir WILLIAM MACEWEN. Scotch surgeon. Born at



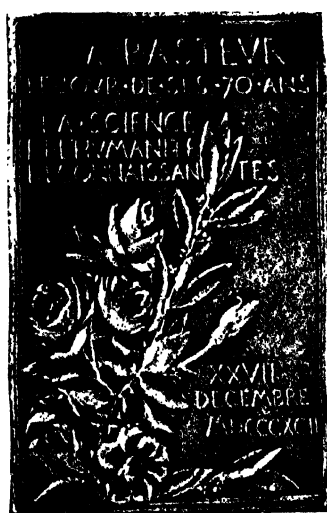
Nº 24. Fig. 33. — DEWAR



Nº 25. Fig. 34. — MACEWEN



N° 26. Fig. 35, 36. — PASTEUR



N° 27, Fig. 37, 38. -- PASTEUR



N° 28. Fig. 39. WÖHLER



N° 29. Fig. 40. — STA

Rothsay, Scotland, in 1848; died in 1924. Surgery of the brain and spinal cord.

Artist : ELIZABETH H. ALEXANDER. Scotch sculptor living in Glasgow (15, Queen's Crescent).

Date : After 1924.

Size : 60 mm.

Collection : Sculptor's.

Obv. : WILLIAM MACEWEN. MDCCCXLVIII-MCMXXIV. (fig. 34).

Rev. : Royal Faculty of Physicians and Surgeons of Glasgow. Non vivere sed valere vita. The Macewen medal in surgery awarded to..... (yearly awarded to the most distinguished student).

The same sculptor made another medal of Sir WILLIAM MACEWEN, somewhat different. It is larger (95 mm.) and bears no legend on the obverse. Reverse : WILLIAM MACEWEN Regius Professor of Surgery in the University of Glasgow, 1892-1924.

This second medal, the so-called University Macewen Medal, is awarded to the most distinguished university student in surgery.

No. 26. LOUIS PASTEUR. Born at Dole, Franche Comté, 1822; died near St. Cloud, 1895. French chemist and biologist. Founder of bacteriology.

Artist : AUGUSTE PATEY. French sculptor and medallist. Born at Paris in 1855. (FORRER's *Dictionary*, vol. 4, 422-28, 1909).

Date : 1889.

Size : 65 mm.

Collection : Cabinet des Médailles, Paris. Courtesy of Mme H. METZGER.

Obv. : LOUIS PASTEUR. Membre de l'Académie des sciences et de l'Académie de médecine. A. PATEY (fig. 35).

Rev. : Hercules crushing the hydra (fig. 36).

No. 27. PASTEUR.

Artist : O. ROTY. (1846-1911). (FORRER's *Dictionary*, vol. 5, 222-49, 1912, portrait in frontispiece).

Date : 1892..

Size : 67 × 48 mm.

Collection : LYMAN C. NEWELL, Boston.

Obv. : LOUIS PASTEUR. Né à Dole le xxvii Décembre MDCCCXXII. Pour la science, la patrie, l'humanité. (fig. 37).

Rev. : O. ROTY. A PASTEUR, le jour de ses 70 ans. La science et l'humanité reconnaissantes. XXVII Décembre MDCCCXCII. (fig. 38).

No 28. FRIEDRICH WÖHLER. German chemist. Born at Eschersheim near Francfort, 1800; died, Göttingen, 1882. Synthesis of urea (1828). Polymerism of cyanic and cyanuric acid, study of benzaldehyde, benzoyl, uric acid, etc. Isolation of aluminium (1827), beryllium (1828); etc.

Artist : EDUARD LÜRSSEN. German sculptor and medallist (*Forrer*, 3, 499, 1907).

Date : 1880.

Size : 98 mm.

Collection : LYMAN C. NEWELL, Boston.

Obv. : Portrait (fig. 39). In memoriam nataliciorum octogesimorum XXXI Iulii A. MDCCCLXXX fauste peractorum.

Rev. : (oak and laurel branches). FRIDERICO WOEHLER naturæ indagatori sagacissimo discipuli amici collegæ.

No. 29. JEAN SERVAIS STAS. Belgian chemist. Born, Louvain, 1813; died, Brussels, 1891. Determination of atomic weights.

Artists : ALPHONSE MICHAUD, Belgian coin engraver and medallist. Born, Brussels, 1860; connected with the Belgian Mint since 1878, its chief-engraver since 1895. (*Forrer*, 4, 64, 1909). This medal is signed « A. MICHAUD d'après L. W. » Indeed there is an undated portrait medaillon of STAS by LÉOPOLD WIENER, Belgian sculptor and medallist, born, Venloo, 1823; died, Brussels, 1891. (*Forrer*, 6, 490-95, 1916).

Date : 1891.

Size : 50 mm.

Collection : LYMAN C. NEWELL, Boston.

Obv. : Portrait (fig. 40). No legend save the signature above-mentioned.

Rev. : Académie Royale des Sciences, des Lettres et des Beaux Arts de Belgique. A JEAN SERVAIS STAS, né à Louvain le 21 août 1813, élu membre de la Classe des Sciences en 1841. Souvenir jubilaire (5 mai 1891).

Notes and Correspondance.

I. The History of Science : Teaching and Personalia.

Edited by HARRY ELMER BARNES (Smith College, Northampton, Mass.).

Editorial Note : The editor of this section respectfully requests teachers and students of the history of science to send to him any personal or pedagogical materials dealing with the history of science to his address, 108 Maynard Road, Northampton, Mass., U.S.A.

1. — **University of Berlin.** — Professor JULIUS RUSKA has been promoted from the University of Heidelberg to the University of Berlin, and his Institute for the study of the history of science, which has already been mentioned many times in *Isis* (e.g., 6, 538) will now be a part of the University of Berlin. G. S.

2. — **University of Leyde.** — Dr. A. SCHIERBEEK, lecturer in general zoology, has offered during the year 1927-28 a course on the history of biology (one hour each week) which was attended by some 35 students. It will be remembered that Dr. SCHIERBEEK is the author of an elaborate history of biology, from ARISTOTLE to PASTEUR, in Dutch, published in Amsterdam 1923 (*Isis* 6, 211) and of an introduction to the study of animal psychology, « Instinct or Intelligence, » also in Dutch, published in Amsterdam in 1927 (*Isis*, 11, 546). G. S.

3. — **Cambridge, Massachusetts.** — One of our most illustrious foundation members, the great chemist, THEODORE WILLIAM RICHARDS, died at his home, 15 Follen st., on April 2, 1928. He was born in Germantown, Pennsylvania, in 1868. Dr. RICHARDS was much interested in the history of chemistry and had offered at Harvard University for many years a course on « elementary theoretical and physical chemistry, including the historical development of chemical theory ». In that respect he was one of the pioneers of the teaching of the history of chemistry in America.

During the second semester of the year 1928-29, Dr. GEORGE SARTON, will give his usual course on the history of XVIII century and XIX century

science at Harvard University, and an introductory course on the history of mathematics at Radcliffe College.

Dr. SARTON was elected a Fellow of the American Academy of Arts and Sciences of Boston (1780) on May 11, 1927; a Fellow of the American Geographical Society (in New York) on February 21, 1928; a Member of the Royal Asiatic Society, on May 8, 1928.

4. — **Princeton University.** — Professor E. G. SPAULDING of the Department of Philosophy at Princeton University has offered a regular course in the History of Science to seniors and graduate students for the last ten years. The course is designed to give an appreciation of the philosophical factors involved in the development of modern science. It consists of two lectures and one preceptorial conference each week during the last half of the university year. H. E. B.

5. — **Washington, D. C.** — FREDERICK E. BRASCH, secretary of the *History of Science Society* has been awarded by the *American Council of Learned Societies* a grant which will enable him to travel in the United States and collect information on the progress of astronomy, physics, and mathematics in colonial days. (April 1928). G. S.

6. — **Dartmouth College, Hanover, N. H.** — JOHN WESLEY YOUNG, professor of mathematics, will offer next year (1928-29) a course on the history of science. H. E. B.

7. — **University of Wisconsin.** — The first volume of the Hollister Pharmaceutical Library was published by the Wisconsin Historical Society in May, 1927. This is a facsimile reproduction of the first edition of the *Pharmacopoeia Augustana*, published at Augsburg, Germany, in 1564. Only two copies of the original edition are known. One of these is in the Library of the University of Würzburg, and it was through the generous efforts of an alumnus of this University, Dr. JOSEPH SCHNEIDERS of Milwaukee, Wisconsin, that the present fac-simile reproduction was made possible. This publication edited by EDGARD KREMERS, was reviewed in *Isis* (10, 69-71, 4 illustr., 1928). H. E. B.

An exhibit case has been built for the University of Wisconsin Medical School, in which monthly exhibits of historical material relating to Medicine are being arranged. The case was opened in April, 1927 with an exhibit of photographs, books, and other material relating to Lord LISTER in commemoration of the centenary of his birth. A similar exhibit case has been used with success at the University of Pennsylvania Medical School for many years. E. K.

2. Miscellanea.

Friedrich August Flueckiger. — The centenary of the birth of FRIEDRICH AUGUST FLUECKIGER, co-author with HANBURY of « Pharmacographia » and well known as the father of modern pharmacognosy, occurred May 15th, 1928. At Wisconsin the event was commemorated by an exhibit.

When FLUECKIGER retired from Strassburg in 1892, he returned to Bern for the purpose of devoting his remaining years to the writing of a history of drugs. His association with HANBURY had acquainted him with the principal drug market in London. His trips to Italy as well as his library researches had revealed to him much of the Levant drug trade of Venice and Genoa. Naturally, he was not unacquainted with American drugs. However, he felt desirous of knowing more about their history. So he accepted a standing invitation of Dr. E. R. SQUIBB and became his guest in Brooklyn for several months during the summer of 1894. Finding it impracticable to visit the Lloyd Library in Cincinnati in person, JOHN URI LLOYD not only sent him a case of books to Brooklyn but made a special trip to New York to place at the disposal of FLUECKIGER his unusual knowledge of North American medicinal plants and drugs.

Dealing with this trip there have appeared in the *N. Y. Apt.-Ztg.* several contributions under the caption of Flueckigeriana. The first of these consists for the most part of letters written by FLUECKIGER to American friends. The second consists of extracts from a diary kept at the time by one of his daughters. A third contribution will consist of letters written by FLUECKIGER during his American stay to TSCHIRCH at Bern. Still others are being contemplated.

The Gesellschaft für Geschichte der Pharmacie has recently commemorated the centenary by issuing an account of FLUECKIGER historian as No. 3 of its « Veroeffentlichungen ». EDWARD KREMERS.

Reviews

The « Book of Surgeries » of Master Thomas Scellinck from Thienen. After the manuscripts of the Royal Library, The Hague, and of the British Museum, London. Published by E. C. VAN LEERSUM, Amsterdam. (*Opuscula Selecta Neerlandicorum de Arte Medica*, fasciculus septimus quem Curatores Miscellaneorum quae vocantur Nederlandsch Tijdschrift voor Geneeskunde collegerunt et ediderunt, Amstelodami, Sumptibus Societatis, 1928).

Dr. E. C. VAN LEERSUM to whom we owe already the best edition of JAN YPERMAN's surgery (Leiden, 1912) has now admirably completed his earlier gift by the edition of another Flemish work of the same kind. SCCELLINCK's work is important, even as YPERMAN's, because it is not a Flemish translation of a foreign work, but an original work. Says the editor « It is the work of a man of experience, who, notwithstanding his respect for the graeco-arabian tradition, and the experience of his immediate predecessors, prefers to trust what his own eyes have seen, his own hands have felt. Repeatedly SCCELLINCK shows himself to possess an independent judgment and he does not neglect to impress this on both his « dear children, THOMAS and JAN » for whom he says this work has been written. For instance, a separate chapter is devoted to his experiences with fractures of the skull, « that is unlike all older physicians ». Also he communicates a recipe of a plaster « better than all others ». He did not wish to be less than those « wise old masters » who liked so much to give their name to a remedy but as one reads what he testifies of « *Salve Gracia Deij* », that it is « good and worthy and works miracles » then one feels involuntarily inclined to ask if it was necessary for him to add a new galenic to a list already hopelessly long. » SCCELLINCK quotes a number of Greek, Muslim and Italian physicians, but does not mention his contemporary YPERMAN (d. 1330-31). YPERMAN finished his *Cyrurgie* in 1310, SCCELLINCK finished his own in 1343. Both works seem independent, as far as contemporary works largely derived from the same sources can be. « One is the writing of a bold surgeon, the other that of a cautious physician, more or less shy of blood. YPERMAN was ready with the knife, SCCELLINCK prefers the redhot iron, or the chemical caustics. And how cautious is his manner of working. For instance, in order to open up

glands or abscessae it is well to administer but a small amount of the caustic on the diseased spot ; this is more prudent than too much all at once. And it is advisable to protect the surroundings by a wall of dough against the corroding agent. YPERMAN dwells at length on ligature of the vessels and the suture of wounds, SCELLINCK writes on unbloody manipulations for the reposition of broken or distorted limbs. The circumstantial manner in which he deals with operations for stones in the bladder is an exception to his preference for the « *petite chirurgie* ». In contrast to YPERMAN, SCELLINCK touches anatomy but lightly. On the other hand, his enumeration of wound-healing remedies is very complete, a whole section of his book is devoted to it. » This new text will make the reader realize once more that mediaeval surgery was not quite as bad and that AMBROISE PARÉ was no quite as revolutionary as is often believed. « The ligature of bleeding vessels was already practised by able surgeons, therefore long before AMBROISE PARÉ described that operation. The suture of wounds was carried out in an efficient way. Unconsciously they acted on antiseptic principles, for the wine with which they rinsed the wounds, the resins and balsams in their plasters and ointments were real antiseptic agents. » For a true revolution in the development of surgery one has to wait until the time of PASTEUR and LISTER.

Very little is known about THOMAS SCELLINCK's personality. He was born probably in Tirlemont, (Thienen; Thenac in montibus), and practised in Namur. He traveled in the Brabant and Namurois, and was at one time in Genoa. Two cases mentioned by him are dated 1317, 1334, and his book was finished in 1343.

This edition begun with the collaboration of GEIJL and W. S. VAN DEN BERG, both of whom died, was completed by Dr. VAN LEERSUM alone. It is a very thorough piece of work. The introduction (in Dutch and English) discusses the Mss. and their contents. Follows the Flemish text with variants in the footnotes (269 pages printed on two columns); list of writers mentioned in the text; additional notes (p. 277-286); a glossary; a bibliography. The glossary is very elaborate p. (287-328); it had to be, for the author had to meet the divergent needs of Dutch philologists without medical training and of physicians without philological training. In short, this edition is an important addition to the historiography of medicine. Dr. VAN LEERSUM has done his task so well that it will be unnecessary to redo it. This is the best way of saving the time of other scholars; — when will every one understand this? It is a *real* step forward.

For previous volumes of this admirable collection, the *Opuscula selecta Neerlandicorum de arte medica*, see *Isis*, 7, 595; 10, 304; 11, 267.

GEORGE SARTON.

Martha Ornstein (1878-1915). — *The rôle of scientific societies in the seventeenth century*. xiv + 308 p. Chicago, University of Chicago Press, (1913) 1928. (\$ 3.)

As the first edition of this book (New York, Columbia University, 1913) failed to be reviewed in *Isis*, I am very glad that a second edition gives me a chance to correct this grave omission. Though the new edition is nothing but a verbatim reprint of the original, it is fully justified because it is still the best account of a great subject. The author who had been trained as a mathematician before starting her historical investigation, had a full understanding of the implications of her task. She had sufficient scientific experience and intellectual maturity not to lose sight of the whole subject in spite of the pains which she took to investigate every detail of it. In other words, she had mastered her subject, in a way which is very remarkable considering that it was her first great effort in this direction and that she was relatively young.

Her work is more than the title promises. It is in fact a study of the general development of scientific method and knowledge in the seventeenth century; a description of the beginnings of modern science. For in spite of COPERNICUS and VESALIUS and a few others, it is clear that the sixteenth century was still essentially mediæval.

The subject is divided as follows. An introductory part contains a sketch of the scientific progress made between 1600 and 1700, and of the work of some of the most prominent investigators who flourished before the birth of the learned societies : GILBERT, GALILEI, TORRICELLI and PASCAL, HARVEY, VAN HELMONT, BACON, DESCARTES, GUERICKE. Part II is devoted to the academies : Lincei, Cimento, the Royal Society (p. 91-138) the Académie des Sciences (p. 139-164); the German academies. This ends with an account of LEIBNIZ, who was the father of the Berlin Academy. The real history of that Academy begins only in 1700, but its incubation in LEIBNIZ's mind is a very important chapter in the history of seventeenth century thought. LEIBNIZ was by far the most encyclopædic mind of the century, and nobody grasped the academic problems more deeply than he did, nor tried to solve them in a more systematic way. Of course, he was able to take advantage of the admirable efforts which had been made in Italy, England, France and his own country, but he addressed himself to this organizing effort, so congenial to his own outlook, with unparalleled enthusiasm and energy. This history of the earliest academies — some of which are still the leading academies of the world — is followed by an account of the earliest scientific journals : the *Journal des sçavans*, the first medical journals, the *Acta eruditorum*, the *Nouvelles de la République des Lettres*, etc. Without these journals, the influence of the new centers of research would have re-

mained necessarily local or regional, but they carried the new spirit all over the world.

A third part, much shorter (p. 213-56) examines the relations between the learned societies and the universities of Europe. This helps to emphasize in another way the importance of the societies for it shows that, with the exception of the medical faculties, the universities contributed little to the advancement of science. Many of the greatest scientists of the seventeenth century were without any affiliation with universities, or their connection with them was but short and casual. The truth is that in the seventeenth century the universities, far from being the nurseries of progress, had become the very citadels of conservatism. To quote ADOLPH HARNACK (*):

« The European universities were born at the high tide of the Middle Ages, and their institutions corresponded to the medieval attitude of transmitting the sum of knowledge in fixed forms. The Academies of Europe belong to the epoch which begins in the middle of the seventeenth century, and their institutions are an expression of the new spirit which was thenceforth to attain its power in the realm of thought and life. »

Or to quote the author herself :

The learned societies « were the *Kulturträger* of the second half of the seventeenth century much as the universities had been before the scientific revolution... They typify this age drunk with the fulness of new knowledge, busy with the uprooting of superannuated superstitions, breaking loose from traditions of the past, embracing most extravagant hopes for the future. In their midst the spirit of minute scientific inquiry is developed; here the charlatanry and curiosity of the alchemist and magician are transformed into methodical investigation; here the critical faculty is developed so that the disclosure of an error is as important as the discovery of a new truth; here the minute fact is put as high — nay, higher — than generalization; here the individual scientist learned to be contented and proud to have added an infinitesimal part to the sum of knowledge; here, in short, the modern scientist was evolved. »

The author of this book, MARTHA ORNSTEIN, was born in Vienna, Austria, on August 19, 1878. She was educated in Vienna, and later obtained various degrees including the Ph. D. (1913) at Barnard College, New York city. The present work was her doctor's dissertation. In 1913, she married Dr. JACOB BRONFENBRENNER and went to Pittsburgh to live; a son was born to her in the following year; she died as a result of a motor accident in April 1915. Much could have been expected from

(*) Geschichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin (vol. 1, 261, 1900). M. ORNSTEIN (p. 261).

one who had made such a brilliant start. The reprinting of this excellent book gave me a welcome opportunity ' to pay tribute to the memory of a noble woman.

GEORGE SARTON.

Franz Xaver Kugler, (S. J.) — *Sibyllinischer Sternkampf und Phaëton, in naturgeschichtlicher Beleuchtung*. 56 pp. (Zeitgemässe Schriften, Nr. 17; ASCHENDORFF, Münster, Westfalen 1927. (1,50 Mark)

On serait surpris de trouver une étude technique de ce genre dans une série de petits livres « au jour le jour », si ce n'était que l'antique orient exerce un empire fascinant sur un cercle de penseurs toujours grandissant. Le numéro actuel contient une analyse de deux passages fort cryptiques des oracles sibyllins, de la main d'un astronome et assyriologue de mérite. Il s'agit des vv. 512-531, d'importance capitale; puis des vv. 206-213, avec des données plus vagues mais assez analogues; tous vers du 5ième livre. Jusqu'à présent aucun éditeur de ces oracles n'a su trouver d'explication pour ces vers. P. KUGLER y trouve une description astronomique fort cohérente, en tant que la bataille des étoiles serait inaugurée par un météore fulgurant — un bolide — traversant les cieux et éclatant. Vénus est à l'est du Lion : elle est étoile du matin; donc le soleil est dans la Vierge et nous sommes en septembre. La bataille même, c'est le grand changement que subit le ciel étoilé au cours des sept mois suivants, c.à.d. jusqu'au 8 avril, environ; — quoiqu'il s'agisse surtout du contraste entre une nuit de septembre et une nuit d'avril. Quand nous lisons au v. 519 *Ταῦρος δ' Αἰγυόκέρωτος ἀφήρπασε νόστιμον ἡμῶν* cela veut dire que le taureau a poursuivi le capricorne par le ciel jusqu'à l'hiver et « lui vole le jour du retour », le capricorne se perdant dans les rayons du soleil à partir de décembre pour longtemps. De même 3 vers plus loin la pléiade ne paraît plus, ayant aussi atteint son coucher héliaque. Ceci permet de fixer le 7 avril comme *terminus post quem* pour la fin du « combat ». Alors Uranus précipite ces constellations dans la mer et toute la terre s'enflamme, c.à.d. l'été brûlant de l'orient commence. Les vv. 206-210 se rapportent également à la première scène; les vv. 211-213 passent de suite à la fin : feu et flamme en Ethiopie.

Le dernier tiers de cette brochure est consacré à l'étude de la légende de Phaëton (surtout d'après NONNOS, *Dionysiaca XXXVIII*) et ses rapports avec les vers susdits. Il appert que Phaëton n'est au fond ni le coucher du soleil — (qui par sa chute enflamme la terre), ni Vénus, mais bien le symbole d'un immense météore, luisant comme le soleil, — voire même d'une pluie de météores. Comme suite : incendie en Ethiopie et possiblement, en même temps, grande inondation en Thessalie, due à la chute soudaine de météores dans la mer égéenne; cf. PLATON, *Timaeus*, 22; ORIGÈNE, *contra Celsum* 1, 19; IV, 11; EUSÈBE (Schöne) 11,

26-28. — De tous ces phénomènes P. KUGLER distingue avec soin le grand feu cosmique des stoïciens.

Sur bien des points de détail les solutions ingénieuses de l'auteur sont convaincantes. On hésite cependant à accepter les sept mois écoulés pour les vers 512 et suiv. Les vers 206 et suiv. se rapportent bien sûr au mois d'août, septembre, et nous aurions voulu voir ce passage traité *avant* l'autre : vv. 512 et suiv. Quelle est l'époque de ces derniers vers ? P. KUGLER dit septembre aussi au début, et parle de suite de l'étoile du matin, puis bientôt des astres du soir à cette époque : il a donc onzes douzièmes de la voute étoilée à sa disposition. Octobre suffirait, nous semble-t-il ; ce « combat » durerait une demi-année : 182.7 jours.

Voici d'ailleurs une traduction de la version allemande qu'a faite le P. KUGLER de la citation la plus importante : *Orac. Sib.* V 512-531.

Je vis la menace d'un « soleil flamboyant » (φαέθοντος) parmi les astres Et l'effroyable colère d'une « lune » dans des éclairs.

Les étoiles enfantaient la guerre; dieu les laissa se battre ;

Au lieu du « soleil » il y eut un chassé-croisé de longues flammes.

L'étoile-du-matin (Φωσφόρος) monta sur le dos du lion et commença la bataille.

La triste lune bicornue changea d'aspect.

Le capricorne frappa au cou le jeune taureau,

Mais le taureau vola au capricorne le jour du retour.

Et Orion prit la place de la balance, de sorte qu'elle ne resta plus.

La vierge se fit remplacer par le bélier à la façon des Jumeaux.

La pléiade ne brilla plus; le dragon évita la ceinture (de l'horizon).

Les poissons s'étiraient en face de la ceinture du lion.

Cancer ne resta pas, car il craignait Orion.

Le scorpion se jeta sur la queue du lion très terrible ;

Et le chien allait partir en glissant à cause d'un rayon du soleil.

Le verseau augmenta la puissance du fort Phaeinos (= Saturne)

Puis Uranos s'éleva lui-même, tant qu'il eût secoué les combattants.

Furieux il les précipita sur la terre.

Projetés donc de la sorte jusqu'au bain de l'océan

Ils mirent toute la terre en feu. — L'éther resta sans étoile.

Les amateurs des sibyllines ne devront pas négliger de consulter cette pièce d'exégèse.

HUGH G. BÉVENOT.

George Rusby Kaye. — *The Bakhshālī Manuscript*. A study in mediaeval mathematics. VI + 156 p., 4 tables, 48 plates, 33 × 24.5 cm. (Archaeological Survey of India, New Imperial Series, vol. 43, Parts 1 and 2). Calcutta, Government of India, 1927 (Rs. 28 or 43 s. 6 d.)
A mathematical work was found in 1881 at Bakhshālī, near Mardān, 50 miles from Peshawar, in the so-called Gandhāra country. It was studied

by the late A. F. RUDOLF HOERNLÉ (1841-1918), who concluded that it was a work of great antiquity and did not hesitate to place it as far back as the third or fourth century. He devoted various papers to it, from 1883 on, and in 1902 presented it to the Bodleian Library. HOERNLÉ encouraged KAYE to continue his investigations and handed over to him most of the material he had himself prepared. KAYE set to work and soon reached very different conclusions with regard to the age of the work. As early as 1912 he published a paper (*Isis*, I, 547), wherein he maintained that the Bakhshâlî Ms. was probably not older than the twelfth century. The present memoir, which contains the earliest complete edition of the Sanskrit text together with an elaborate introduction, reiterates with greater authority the conclusions already reached by the author fifteen years before.

The Bakhshâlî Ms. consists of some 70 leaves of birch bark, not more than half of which are in fair condition. Even these are broken at the edges; the other leaves are far more damaged, and eleven are hardly more than scraps. The original size of the leaves was probably c. 17 by 10.5 cm. The language may be described as an irregular Sanskrit. Nearly all the words used are Sanskrit and the rules of Sanskrit grammar and prosody are followed with some laxity. The script is Sâradâ. The work was written not by a Jain or Buddhist (as HOERNLÉ believed) but by a Saivite Brahman.

The remains of the Ms. contain the following items: «Problems involving systems of linear equations. Indeterminate equations of the second degree. Arithmetical progressions. Quadratic equations. Approximate evaluations of square-roots. Complex series. Problems of the type $x(1-a_1)(1-a_2) \dots (1-a_n) = p$. The computation of the fineness of gold. Problems on income and expenditure, and profit and loss. Miscellaneous problems. Mensuration.»

«Although the work is arithmetical in form it would be misleading to describe it as a simple arithmetical text-book. No algebraical symbolism is employed, but the solutions are often given in such a general form as to imply the complete general solution, *i. e.*, the solutions, though arithmetical in form, are really generalised arithmetic, or algebra. First of all a particular rule is given, which is intended to apply to the particular set of examples that follows. These rules are often expressed in language that would be impossible to interpret without the light thrown upon them by the solutions. The examples are themselves sometimes trivial, but the solutions, often expressed with what at first glance appears to be meticulous care, often redeem the examples from their apparent triviality. Proofs or verifications are often given with some elaboration and on occasions are multiplied.»

«Large quantities are dealt with and one particular number contains

23 digits. These large numbers do not appear to be given for mere effect for they occur quite naturally as the result of a rigorous logic. Indeed the author seems generally to prefer simple numbers. These large quantities again lead us to note rather special characteristics of the work, namely the apparently over-elaborated exposition of the « workings » of the solutions, to the preservation of the generality of the solutions throughout such workings, and to the consequent necessity of preserving the quantities that occur so that the penultimate statement shall involve the whole formula. That is, although every operation is arithmetical in form, the quantities involved are not « simplified » or « cancelled » without some special justification until the final result is achieved. The (unwritten) rule followed by the author was something like this : The integrity of the method of solution must be preserved, and so long as it is preserved the calculation may be simplified — otherwise not. Indeed the numerical quantities in these problems are treated almost like algebraic symbols. »

The scheme of exposition of each problem may be represented as follows : « *Sûtram* or rule; *udâharanam* or example; *sthâpanam* or statement; *karanam* or solution; *pratyayam* or verification.

The only distinct mathematical sign used is the sign +, placed *after* the number affected, to indicate a *negative* quantity. This may have been derived from DIOPHANTOS's use of the letter psi upside down for the same purpose; or else from the abbreviations *ka* or *nû* of the Sanskrit words *kanîta* and *nyûna*, meaning diminished; or from other sources. It is impossible to tell.

Chapter 6 (p. 38-53) giving an analysis of the mathematical contents of the text will be of special interest to our readers, as also chapter 7 (p. 54-68) on measures. The latter contains methods for indicating the change ratios of certain measures, which are almost unique in Sanskrit literature.

With regard to the sources of the Bakhshâlî Ms., it is well to remember first of all that the Gandhâra country where it was found and where it probably originated was a cross road of nations. Between the fifth century B. C. and the fifth century A. D. the country round Bakhshâlî was dominated by several different peoples : Persians, Macedonians, Mauryas, Bactrian Greeks, Scythians, Parthians, Kushans; later it was more or less subject to the Guptas and their successors and to the Muslim invaders. As above said, the treatise was written by a Hindu (Saivite), not by a Buddhist or Jain, yet in some matters of detail (without religious importance) it more closely resembles the *Ganitasârasamgraha* of MAHÂ-VÎRA than any other Sanskrit work. (*)

(*) MAHÂVÎRA (first half of ninth century) was a Jain. See SARTON's *Introduction* (I, 570).

Two points suggest western (probably Muslim) influence. « The Indians, although they adopted the western sexagesimal notation for astronomical purposes did not utilise this notation for purposes of arithmetical calculation. On the other hand the Muslim mathematicians commonly employed this notation to express ordinary fractional quantities. Now in the Bakhshâlî Manuscript is an example of the transformation of a simple fraction expressed in the ordinary way to the sexagesimal notation. This transformation may be represented by

$$\frac{178}{29} = 6 + 8' + 16'' + 33''' 6^{IV} \frac{6}{29}$$

No such example occurs in any early Hindu work and there is not the slightest doubt that it indicates direct western influence. Indeed our author could have hardly provided us with a more conclusive piece of evidence. Again our manuscript exhibits a method for finding approximate roots of surd quantities that is not Indian. The method may be represented by $\sqrt{A^2 + b} = A + b/2A$ approximately, and closer approximations may be achieved by continuing the process. The *sûtra* embodying this method is given three times and a number of examples of first and second approximate evaluations is given. Indeed this square-root method is one of the most prominent topics of the work. Its history is quite well known. It occurs in many western works from the time of HERON onwards but it occurs in no Indian work earlier than the twelfth century : indeed the earliest record of this method in an Indian work (other than the Bakhshâlî Manuscript) known to me is of the 16th century ! »

KAYE's conclusions with regard to the age of this text are largely based upon script and language, and his discussion is too technical to be reproduced here. His final words are : « Of the evidence as to age discussed some is of doubtful value; but there remains a good deal that must be considered as giving no uncertain indication, and the period indicated is in all cases about the twelfth century. The script, the language, the contents of the work as far as they can give any chronological evidence, all point to about this period, and there is no evidence whatever incompatible with it. » I am entirely unable to discuss the palaeographic and linguistic arguments. I shall simply point out that the resemblance with MAHÂVÎRA might suggest at least the possibility of a somewhat earlier date, say the tenth century; but even that date would be considerably later than the one proposed by HOERNLÉ.

The second part of KAYE's memoir (p. 85-156) is devoted to an elaborate palaeographical discussion, with four comparative tables, and to a very careful edition of the text transliterated in our alphabet. This is followed by 47 plates reproducing the whole text in facsimile. Whether KAYE's conclusions as to the relative lateness of the Bakhshâlî Ms. are accepted

by Indianists or not, he cannot be denied the honor of having given us not only the first critical edition of the text, but also a complete survey of all the problems involved, as far as it can be done today. All further studies will need to be based upon this pioneer effort.

One hopeful method of advancing our knowledge is suggested by KAYE himself (p. 4). Some of the leaves of the Ms. are now stuck together, and it would seem possible to separate them, which might bring to light new material. This ought to be done as soon as possible, and why not under KAYE's own direction?

GEORGE SARTON.

Abr. Clod-Hansen (décédé en 1925). — *Anatomie mandchoue*. Facsimilé du Manuscrit no. 11 du Fonds oriental de la Bibliothèque Royale de Copenhague. Publié par VICTOR MADSEN. Traduction du texte mandchou par VILHELM THOMSEN. Un vol. in folio, 16 p., 90 pl. Copenhague, Bibliothèque royale, 1928.

Ce Ms. écrit sur du papier chinois jaunâtre et relié à la chinoise mesure 31,5 × 24 cm. Il fut acheté à Péking en 1901 et donné à la Bibliothèque nationale de Copenhague en 1906. Les figures sont identiques à celles d'un autre Ms. chinois donné à la Bibliothèque royale de Paris en 1723 par l'auteur, le R. P. DOMINIQUE PARENIN. Ceci permet d'en écrire l'histoire exactement. L'empereur K'ANG-HSI (1662-1722) étant tombé gravement malade, prit intérêt à l'anatomie. Les missionnaires jésuites se mirent donc à lui préparer une collection de dessins anatomiques. Le travail fut commencé par le père J. BOUVET, puis interrompu, et repris en 1694 ou plus tard par le père PARENIN.

Le travail de PARENIN est essentiellement basé sur l'anatomie de PIERRE DIONIS (Paris, 1690); la plupart des gravures sont calquées sur celles de l'anatomie de THOMAS BARTHOLIN (Lyon, 1677). Aux figures, le P. PARENIN ajouta de brèves légendes en mandchou; les planches sont numérotées en chinois; un numérotage en chiffres arabes paraît postérieur. D'après l'indication donnée plus haut, l'œuvre fut achevée peu de temps avant 1723. La couverture du Ms. porte en caractères chinois, le titre suivant : Dessins des vaisseaux de tout le corps, aspect de tous les organes intérieurs.

Cette reproduction facsimile, faite sous les auspices de la Fondation Carlsberg, est admirable. Les légendes mandchoues ont été transcrites et traduites en français par le regretté VILHELM THOMSEN. Les deux savants qui se sont le plus occupés de cette publication, A. CLOD-HANSEN et V. THOMSEN étant morts avant son achèvement, on conçoit que celle-ci soit restée incomplète; toutefois le manque d'un glossaire mandchou me paraît inexcusable.

G. S.

Julián Ribera y Tarragó. — *Disertaciones y opúsculos*. Edición co-

lectiva que en su jubilación del Profesorado le ofrecen sus discípulos y amigos (1887-1927). Con una introducción de MIGUEL ASÍN PALACIOS. 2 vols. CXVI + 637 p.; VIII + 797 p. Madrid, ESTANISLAO MAESTRE, 1928. (30 pesetas).

DON JULIÁN RIBERA, the great Spanish Arabist, whose works have often been praised in *Isis*, was born at Carcagente, in the province of Valencia, in 1858; he was a disciple of FRANCISCO CODERA Y ZAIDÍN (1836-); was appointed professor of Arabic at the University of Saragossa in 1887, and of Jewish and Muslim civilization at the Universidad Central of Madrid in 1905. In the year 1927, his many disciples and friends enjoyed the privilege of celebrating his golden jubilee as a teacher.

The present volumes, containing a collection of his shorter works, are a belated fruit of that great anniversary. Is this not the finest way of celebrating a great scholar? How superior to the barbaric practise of editing a Festschrift, which is too hard an imposition on many scholars and condemns many valuable writings to an unjust oblivion. It has been my experience indeed that papers published in Festschriften are often very difficult to reach and are easily forgotten. The number of copies printed is generally small, and after the course of one or two generations almost unobtainable except in very large libraries. Each Festschrift contains a few papers which are but indirectly connected with the main subject, and it is these papers which are especially difficult to locate after a few years.

In other words, the editing of Festschriften is a process of disintegration; while the editing of the collected writings of a great scholar is a process of integration. Thus we are very grateful to the organizers of this undertaking, and especially to the editor, MIGUEL ASÍN Y PALACIOS, illustrious disciple of an illustrious master. Our readers are sufficiently well acquainted with his own works (see e. g., *Isis*, 10, 65-69) to make a further introduction necessary. But I would remark that any country might be proud of such a tradition as is epitomized by these three names : CODERA, RIBERA, ASÍN !

DON MIGUEL opens the work with a biographical introduction, illustrated with a beautiful portrait (102 p.) This is followed by Don JULIÁN's writings, which I shall presently enumerate with a few remarks, an attempt to analyze them even briefly being obviously out of the question.

Part I. *Arabic history, literature and civilization*. The *cancionero* of ABŪ BAKR MUḤAMMAD IBN 'ABD AL-MALIK IBN QUZMĀN, who died at Cordova in 1160 (1912). Andalusian epic poetry (1915). Origins of RAMÓN LULL's philosophy (1899). Booklovers and libraries in Muslim Spain (1896; *Isis*, 11, 516). Education in Muslim Spain (1893, *Isis*, 11, 516). Origin of the Nizāmī madrasa in Baghdād (1904). The chronicle of ABŪ 'AB-

DALLÂH MUHAMMAD IBN AL-ĤÂRITH AL-KHUSHANÎ, fl. c. 969, Cordova (1914). Arabic and Aljamiados (*) Mss. of the Biblioteca de la Junta, Madrid (1912). IBN AL-QÛṬĪYA and his chronicle, second half of the tenth century (1926; *Isis*, 11,421). The Spanish Arabist. Discourse pronounced when MIGUEL ASÍN was received in the Real Academia, 1919. The pseudo-Arabist, a criticism of MATÍAS RAMÓN MARTÍNEZ Y MARTÍNEZ : Historia del reino de Badajoz durante la dominación musulmana (Badajoz, 1905). Moorish superstitions (1899).

Part 2. *Historical methods*. Nine essays dealing with the meaning of history, the scientific and artistic aspects of it; etc. This completes volume one.

Part 3. *History of music*. Musical value of the Cantigas (1921). Andalusian music in Europe, extracts from the study entitled La música andaluza medieval en las canciones de Trovadores, Troveros y Minnesinger (1923-25; *Isis*, 11,496). Music of the Minnesinger and its relations with the popular music of Spain (1925). Galician music and prosody (1925). Arabic origin of Romance words relative to music (to be published in the *Homenaje* in honor of the Portuguese scholar D^a. CAROLINA MICHAËLIS DE VASCONCELLOS). History of popular music (1927). I am very glad to announce that Don JULIÁN's book on Andalusian music (1925; *Isis*, 11,497) has been translated into English by Miss ELEANOR HAGUE, of Pasadena in California, and will soon be published by the Stanford University Press.

Part 4. *History of Muslim Valencia* (p. 177-362). Twenty two papers.

Part. 5 *Spanish Morocco*. (p. 365-480). Three historico-political studies.

Part 6. *Teaching* (p. 483-796). Five papers on educational problems in Spain. The three following titles are quoted, as they are very significant. Fathers must guide their children's education. Examinations in China and the philosophy of examinations. The suppression of examinations (bravo!).

Part 7. *Varia*. Twenty six papers.

The only drawback of this book is the lack of an index. This is almost unpardonable, considering the variety and richness of its contents. I often think that the compilation of an index is the nearest approach in the scholarly field to a pure deed of mercy, — but it would be ungracious to insist upon this. My earnest wish is that Don JULIÁN will continue to work with us so long that it will be eventually necessary to publish a third volume, and then it will be time enough to think of the index.

GEORGE SARTON.

Florian Cajori. — *The Early Mathematical Sciences in North and*

(*) Spanish in Arabic script.

South America. 155 pp. with 16 plates, Boston, RICHARD G. BADGER, 1928.

This valuable work includes a brief discussion of Mathematics, Practical Astronomy and Surveying, Surveys and Maps, Meridian Measurements of the Earth, Transit of Venus in 1761 and 1769, Comets, Almanacs, Orreries, Earliest Permanent Observatory in America, Physics, and Societies, Academies, and Journals, all as found in the new world from the period of the discovery into the nineteenth century. Obviously within the compass of 155 pages only a brief survey can be given to the immense amount of material in these fields, largely not yet systematically touched by any historian.

Several of the chapters are elaborations of articles published by Professor CAJORI in *Isis*, in the *Scientific Monthly*, and in other journals.

In the first chapter the omission of the Maya hieroglyphic symbols on the pure vigesimal system is unfortunate, leaving only the mixed twenty and eighteen system as found in the astronomical records. The date of the «American Instructor» by GEORGE FISHER (not «Fischer») is 1748 and not 1747, as the reviewer indicated in his published list of arithmetics printed in America before 1800. According to MEDINA the «Logaritmos» (p. 19) was never printed either in Mexico or elsewhere.

The bibliography could be supplemented by earlier American items in several chapters. On astronomy the first new world publication is the *Physica Speculatio*, by Father ALPHONSO A VERA CRUZ, published in Mexico in 1557. In Physics the following works should certainly be mentioned: ISAAC GREENWOOD, *An Experimental course on Mechanical Philosophy*, Boston: 1726; CADWALLADER COLDEN'S, *An Explication of the first cause of action in matter, and, of the cause of gravitation*, New York: 1745; EBENEZER KINNERSLY, *A course of experiments in that curious and entertaining branch of natural philosophy, called electricity; accompanied (sic) with explanatory lectures; in which electricity and lightning will be proved to be the same thing*, Philadelphia, 1764; CHRISTOPHER COLLES, *Syllabus of a course of Lectures on Natural Experimental Philosophy*, Broadside, Philadelphia, 1773.

Under Orreries ISAAC GREENWOOD'S *Prospectus of Explanatory lectures on the Orrery* published at Boston in 1734, indicates an interest in that subject fifty years before the work of POPE and RITTENHOUSE. Similarly worth mentioning is the work of THEOPHILUS GREW, *The Description and Use of the Globes, Celestial and Terrestrial Spheres*, published in Germantown, Pennsylvania in 1756. This latter work includes also plain and spherical trigonometry. On mathematical instruments the *Elementa recentioris philosophiae* by JUAN BENITO DE DIAZ DE GAMARRA Y DAVILOS (Mexico, 1774) gives six plates of geometrical figures and scientific

instruments; included in the work is a geometry, probably the first in the new world.

It should be noted that the transactions of the American Philosophical Society were first published in 1769 (not 1771) as a supplement of the *American Magazine* and a copy is possessed by the Library Company of Philadelphia.

In the discussion of surveys it is possibly worth mentioning that the first printed map indicating surveys in America is the map of the Bermudas printed in Amsterdam in 1622. This map appeared in SPEED's Atlas in England, and in the great atlases of JANSSON and of BLAEU. Apparently the first map printed in the new world was that of some of the West Indian Islands, issued by the printer and Professor of Mathematics, JUAN RUIZ, appearing in 1658 to accompany MONTEMAYOR's DE CUENCA's *Discurso Politico-Historica*. The same JUAN RUIZ should have been mentioned as writing the first American work on the Aurora Borealis, in Mexico in 1653, since two later works are mentioned (p. 40 and p. 134).

A great deal of work remains to be done on the early history of the mathematical sciences in America. In this treatise by CAJORI future historians will find stimulating suggestions as well as many important bibliographical references.

(University of Michigan)

LOUIS C. KARPINSKI.

May 22, 1928.

Catalogue des manuscrits alchimiques grecs publié sous la direction de J. BIDEZ, F. CUMONT, A. DELATTE, O. LAGERCRANTZ, et J. RUSKA. Volume 5. 1. Les manuscrits d'Espagne, décrits par C. O. ZURETTI. 2. Les manuscrits d'Athènes, décrits par A. SEVERYNS. vi + 175 p. Bruxelles, LAMERTIN, 1928. Vol. 6. MICHEL PSELLUS. *Epître sur la Chrysopée. Opuscules et extraits sur l'alchimie, la météorologie et la démonologie*, publiés par JOSEPH BIDEZ. En appendice, PROCLUS, sur l'art hiératique. PSELLUS, choix de dissertations inédites. xiv + 246 p. Bruxelles, LAMERTIN, 1928.

I gave a long account of this *Catalogue* when the first and third volumes appeared in 1924 (*Isis*, 7, 507-11), and I spoke of it again, when volume 2 was published in 1927 (*Isis*, 11, 244). For the sake of readers who missed these two reviews it will suffice to say that this great work undertaken under the auspices of the International Academic Union, is of fundamental importance for the study of alchemy. Indeed it has exactly the same importance for alchemy as the *Catalogus codicum astrologorum graecorum* (*Isis*, 6, 206) for astrology. I may add that it is so truly fundamental that the average historian of chemistry will not be able to use it profitably. When the *Catalogue* is completed it will be necessary for a number of philological chemists to extract from it, or rather from

the Mss. described in it, all the substantific marrow which they contain and to offer it in such form that the historian of chemistry may finally be able to assimilate it and to introduce it into the texture of his own works. Thus do all investigations progress by the collaboration of a number of scholars working so-to-say at different levels.

Two more volumes of the *Catalogue* have just appeared. Volume 5 is devoted to the Spanish and Athenian Mss. The description of the former by C. O. ZURETTI, professor at the University of Milano, is by far the longest, covering 137 pages out of 173. The learned author has not described only the Mss. which are still extant, but has taken great pains to collect all available information on the Mss. which were destroyed in the fire of the Escorial in 1671. In all seven Mss. are carefully described, and some idea is given of four more which are lost. An appendix deals with four Mss. of the *Libri Koeranidum*. This is followed by a number of significant extracts, and a valuable analysis of earlier Mss. catalogues used by the author.

The Athenian part compiled by A. SEVERYNS, foreign member of the Ecole française d'Athènes, is astonishingly short and poor. The most diligent search in all the libraries of Athens failed to reveal more than three alchemical Mss. ! And of these three, only one, a *Gnomologia* by the monk ANTONIOS, is relatively old (thirteenth century). The two others date from the eighteenth and nineteenth centuries. SEVERYNS did not attempt as thorough an investigation of the Greek libraries outside of Athens, but by means of a number of catalogues (here listed), he found two other modern Mss. (eighteenth century) in Mt. Athos (Vatoped., 665) and in Zagora. This extreme paucity of Mss. in Athens and Greece is disappointing, but not very surprising, as I shall have occasion to show in volume 2 of my *Introduction*.

Volume 6 edited by J. BIDEZ, of the University of Ghent, — one of the leaders of the whole undertaking — is a sort of intermezzo and a very welcome one. Indeed this is not a catalogue, but a critical edition of important texts. It contains PSELLOS's Epistle on the making of gold addressed to the Patriarch MICHAEL I. CERULLARIOS (patriarch from 1043 to 1058). This was written by PSELLOS in his youth; probably in 1045-46, when he was twenty seven. The Greek text is here published together with an anonymous Italian version, found by ZURETTI in a sixteenth century Ms. This work is not very original — we would hardly expect a work of PSELLOS to be — yet many passages evoke the scientific velleities which were beginning to manifest themselves in Constantinople in the eleventh century. Moreover PSELLOS knew Latin, was connected with eastern scholars, and possibly had some knowledge of Arabic alchemy through Greek translations. However BIDEZ's reference to SYMEON

SETH is misleading, for as far as we know, the results of SETH's activity were not yet available in 1045. — At any rate in this Epistle, as in other writings, PSELLUS shows that he had a modicum of scientific spirit, which, humble as it was, can not be praised too much, when one replaces him in his environment. This important feature is so well brought out by the learned editor that I beg leave to use his own words.

« Ce qui est bien de lui assurément, c'est l'esprit qui l'anime dans ses recherches. A la fin de l'antiquité, on lisait chez les plus lettrés des chrétiens que la science a tort de prétendre expliquer les phénomènes de la nature, comme si les caprices des démons n'y étaient pour rien, et qu'il est vain, par exemple, de chercher aux tremblements de terre une autre raison que le châtement mérité par les péchés des hommes. Peu vous importe, écrit quelque part PSELLUS à ses élèves, de trouver pourquoi il arrive au sol de s'entrouvrir. Vous vous contentez de dire que Dieu est la cause des tremblements de terre; votre philosophie ne va pas plus loin. Il s'indignait de voir que, de son temps, l'étude de la nature laissait la plupart des lettrés indifférents : cette indifférence n'était que trop favorable, d'après lui, au réveil ou à la survivance des superstitions antiques. Si la nature a des arcanes, c'est la science et non une théurgie diabolique qui doit se charger de nous y initier. C'est ainsi que, rencontrant un jour une racine de chêne pétrifiée, le jeune PSELLUS en note minutieusement l'aspect, puis rapproche de ce phénomène celui des eaux incrustantes, afin qu'une explication rationnelle enlève à l'étrangeté du fait toute apparence de merveilleux.

C'est dans les lois naturelles aussi, dit-il dans l'introduction de sa *Chrysopée*, qu'il faut chercher la cause de la transmutation des métaux. On a eu tort de croire qu'il y a là une connaissance d'initié, destinée à demeurer secrète. Ce prétendu prestige n'a rien que de fort intelligible. L'opération de l'alchimiste trouve son explication dans la théorie aristotélicienne des quatre éléments, d'où tout provient par combinaison et où tout retourne par dissolution. Ce n'est d'ailleurs pas dans sa *Chrysopée* seulement que PSELLUS proteste ainsi contre le charlatanisme des occultistes et des thaumaturges. On le voit répéter maintes fois que rien ne se produit sans cause, bien que nous ne réussissions pas à trouver la cause de tout, et que c'est notre incompréhension des phénomènes qui fait naître la croyance aux prodiges. Lorsqu'il parle ainsi, PSELLUS n'a, pour s'inspirer, qu'une soudaine renaissance de l'esprit scientifique. »

The *Chrysopoeia* is followed by various other treatises of PSELLUS, which I must mention more briefly. (1). On lightning, thunder, thunderbolts, etc.; (2) On rain, hail, snow, white frost, and dew; (3) On winds; (4). On thunder, lightning, thunderbolt, storm (πρηστήρ), stormy wind (έκνεφίας) and typhoon (τυφών); (5) Extracts from PSELLUS's accusation of his patron MICHAEL CERULLARIOS, written towards the end of the latter's rule and life. He reproaches the old patriarch for having been too much interested in alchemy (2 1/2 p., with French translation). This confirms the impression left by the *Chrysopoeia* : PSELLUS himself was nothing but a « literary » alchemist. It is probable that he had never worked in a laboratory, or even visited one; or else, he had never really assimilated the uncongenial knowledge thus ob-

tained; (6) The treatise on demonology, to which EMILE RENAULD attracted attention a few years ago (1920, *Isis*, 5, 212, or my Introduction, vol. I, 750). This contains examples of that Pythagorean arithmology which was developed by IAMBlichos and his school.

An appendix contains PROCLOS's essay on the hieratic art of the Greeks, and additional short texts or fragments from PSELLOS's writings, too many and most of them too remote from alchemy *stricto sensu* to be quoted. This volume is an important contribution to our knowledge of PSELLOS and his time. But considerable work remains to be done before it will be possible to draw a satisfactory portrait of his very complex and enigmatic personality.

GEORGE SARTON.

Dorothea Waley Singer, assisted by Annie Anderson. — *Catalogue of Latin and vernacular alchemical manuscripts in Great Britain and Ireland, dating from before the XVIth century*. Volume I. XXIII + 326 p., 1 pl. Brussels, LAMERTIN, 1928.

Mrs. SINGER's great work of which I have just received this first volume is a most valuable complement to the catalogue of Greek alchemical manuscripts. It is printed in the same style as the volumes of the Greek catalogue, at the expense of the British Academy, under the general patronage of the International Academic Union. It will be exceedingly useful especially to the students who are now investigating the Arabic sources of western alchemy, and therefore I hope that its publication will soon be completed. To indicate the richness of the available alchemic literature in Latin and western vernaculars it will suffice to remark that this first volume, presumably less than half of the whole work, contains the descriptions of 385 separate texts.

The classification of this material is extremely difficult because of its essential heterogeneity. There were apparently from the very beginning two distinct streams of thought, the one technical, the other mystical, but they became very soon involved and mixed in various degrees. Similarly Egyptian, Greek, Arabic influences were gradually intertwined into a common texture. The iconoclastic disputes in the Byzantine empire (eighth and ninth centuries) led to the dispersal of artificers, some of whom emigrated to the west. Mrs. SINGER quotes an interesting illustration of this, new to me. «In the work of the eleventh century chronicler, ADAM OF BREMEN, we read of a converted Jew named PAUL who, after having visited Byzantium, came to Bremen bringing with him the art of transmuting copper into gold».

It is worth while to reproduce the plan of Mrs. SINGER's work :

Part A. — *Greek and Arabist alchemy in prose*. 1. The «Turba Philosophorum», and commentaries thereon. 2. Other collections of «Dicta of the Philosophers.» 3. The «Tabula Smaragdina» of «HERMES»

and commentaries thereon : the « Secretum Secretorum » of « ARISTOTLE » and commentaries thereon. 4. Other alchemical prose works ascribed to Greek authors. 5. Alchemical prose works ascribed to Arabic and Arabist authors.

Part B. — *Western alchemy in prose*. 6. Alchemical prose works ascribed to Latin authors. (Here ends Volume I.)

Part C. — *Anonymous alchemical prose works*. 7. Synonyma. 8. Names and symbols of planets and metals. 9. Tables and figures without texts. 10. Mercury. 11. Metallic waters and oils. 12. Alchemical apparatus. 13. Miscellanea.

Part D. — *Alchemical verse and commentaries thereon*. 14. Alchemical verse attributed to Arabist authors : the « Gemma salutaris » of RHAZES and commentaries thereon. 15. Alchemical verse attributed to Latin authors. 16. Anonymous alchemical verse.

Part E. — *Chemical crafts and natural magic*. 17. Pigments. 18. « De Vitreis », « De gemmis faciendis », « De arte aurifabri et argentarii », « De coriis » etc. 19. Greek fire, gunpowder and pyrotechnics. 20. Wines and strong waters. (a) Texts attributed to authors. (b) Anonymous texts. 21. « De Naturis Rerum » with sections concerning minerals, pigments, etc. 22. Collections of natural magic, etc., that include chemical experiments, etc. (a) Texts attributed to authors. (b) Anonymous texts. 23. Panaceas.

Part F. — *Alchemical and technical recipes and notes*. 24. (a) Latin; (b) English; (c) French; (d) German; (e) Italian; (f) Spanish.

Appendix I. Kyrannides. II. Some references to alchemy and chemical craftsmanship in legal archives, etc. Index I. Initia and titles. II. Names, places and languages. III. Manuscripts. IV. Alchemical illustrations. V. Abbreviated references. Addenda and Corrigenda.

This new instalment of Mrs. SINGER's complete catalogue of the scientific Mss. of England (for which see *Isis*, 3, 271-74; 4, 186; 7, 510) is an indispensable tool for the historian of alchemy, as well as for the student of mediaeval science.

GEORGE SARTON.

ISIS

**International Review devoted to the History of Science
and Civilization
Quarterly Organ of the History of Science Society.**

SUMMARY

of No. 38 (Vol. XII, 2)

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Report of the Fifth Annual Meeting of the History of Science Society.

(New York, December 28-29, 1928)

This meeting was the third bi-annual meeting with the American Association for the Advancement of Science, and also the fifth annual meeting of the Society. Its policy is to meet in alternated years with the American Association for the Advancement of Science and the American Historical Association, therefore the Society will meet with the latter Association in 1929 at Duke University, Durham, N. C.

The program presented in New York was the *History of Medicine and Civilization*, in conjunction with the American Association for the Advancement of Science and the New York Academy of Medicine. The meeting was held in the beautiful hall of the Academy at Fifth Ave. and 103rd Street on Friday afternoon, December 28 at 2.00 o'clock and a second session on Saturday morning, December 29 at 9.00 o'clock. Before and after the meeting the members had a remarkable opportunity to view the splendid exhibit of 15th and 16th century books pertaining to the history of medicine. This exhibit was arranged by the Librarian of the Academy, Dr. ARCHIBALD MALLOCH.

First Session, Friday afternoon, 2.00 o'clock.

(Each speaker allowed 30 minutes.)

Dr. LINSLEY R. WILLIAMS, *Director*; Address of Welcome, New York Academy of Medicine.

Dr. LYNN THORNDIKE, *President*; History of Science Society, Presiding.

1. *Relation of Medicine to Magic and Science.* Dr. LYNN THORNDIKE
Columbia University, New York.
2. *Teaching of Medicine in the Middle Ages.* Dr. DAVID RIESMAN
Physician, Philadelphia, Pennsylvania,

3. *Medicine and Its Relation to Anthropology and Ethnology*,
 Dr. T. WINGATE TODD
 School of Medicine, Western Reserve University, Cleveland,
 Ohio.
4. *Mutation in Historic Consciousness and the Continuance of
 Medical Ideas* Dr. JOHN C. HEMMETER, Physician, Baltimore,
 Maryland
5. *Role of Physicians as Poets and Men of Letters* Dr. GERALD B. WEB
 Physician, Colorado Springs, Colorado
6. *Role of Catholic Physicians and Scientists in the Advancement
 of Civilization* Dr. JAMES J. WALSH Physician, New York City
7. *Medical Men in Mathematics, Astronomy and Physics*,
 FREDERICK E. BRASCH
 Library of Congress, Washington, D. C.

Second Session, Saturday morning, 9.00 o'clock.

(Each speaker allowed 30 minutes.)

Dr. WM. H. WELCH, *Director*, Institute of the History of Medicine,
 Presiding.

1. *Impressions Concerning Present Conditions of the Teaching and
 Study of Medical History in Europe* . Dr. WILLIAM H. WELCH
 Institute of the History of Medicine, Baltimore, Maryland
2. *Medical Science versus Religion As a Guide to Life*,
 Dr. HARRY E. BARNES
 (Address, Retiring Vice President for Section L)
 Smith College, Northampton, Massachusetts
3. *Medicine As An Agency in the Advancement of Science, Art
 and General Civilization* . . . LT. COL. F. H. GARRISON
 Army Medical Library, Washington, D. C.
4. *The Relation Between Medicine and Philosophy*,
 Dr. MORRIS R. COHEN
 College of the City of New York, New York
5. *Relation of Medicine to Psychology* . . Dr. JOSEPH JASTROW
 Psychologist, New York City
6. *Medicine's Contribution to Biology and Physiology*,
 Dr. VICTOR ROBINSON
 Physician, New York City

7. *Medical Men As Early American Geologists,*

. Dr. WILLIAM BROWNING
Physician, Brooklyn, New York

8. *Relation of Medicine to the Art of Printing,*

. Dr. EDWARD C. STREETER
Physician, Boston, Massachusetts

The Society has lost by death this last year seven of its earliest members namely, Dr. EDGAR F. SMITH, President from January to May 1928, a former Vice-President Dr. LOUIS J. PAETOW, Dr. T. W. RICHARDS, Dr. A. C. COOLIDGE, Dr. ALEXANDER ZIWET, Dr. T. C. CHAMBERLIN and JONATHAN WRIGHT.

Following the Friday afternoon session the Council of the Society held its meeting with the President, Dr. LYNN THORNDIKE in the Chair. Members of the Council present were Dr. SARTON, Dr. TYLER, Dr. BARNES, Dr. MAYER, Dr. WALCOTT, Dr. BIGELOW and Dr. SIMONS, and the Secretary-Treasurer. The election of officers for the ensuing year (1929) was the first business called for. Those elected were Dr. LYNN THORNDIKE, President; Vice-Presidents, Dr. HENRY CREW and Dr. H. W. TYLER; Recording Secretary, Dr. JOSEPH MAYER; Corresponding Secretary and Treasurer, F. E. BRASCH; and following are the new members of the Council Dr. FIELDING H. GARRISON, Dr. HARRY E. BARNES, Dr. W. CARL RUFUS, Dr. GREGORY WALCOTT and Dr. KARL SUDHOFF (Germany). Dr. SARTON presented his report on the status of *Isis* and the Editors' personal support to it. Mr. BRASCH presented the financial status of the Society and its present support to the journal. Dr. THORNDIKE presented a statement of the present movement to organize an International Committee for the History of Science as outlined in a report sent by Dr. MIELI of Paris. No action was taken, but the President expects to attend the conference called by Dr. MIELI in May 1929 to be held in Paris. Dr. TYLER presented an informal report on what had taken place in Oslo at the Historical Congress. The matter of having a representative at the Pan-Pacific Congress to be held in Java was also discussed but no definite action was taken, except that the Secretary should investigate the possibility of selecting a delegate and report to the President. Council approved of the

Society meeting at Duke University, Durham, N. C. in December 1929. Meeting adjourned at 6.45 P. M.

It was requested that a list of the past officers of the Society be annexed to this report as many new members are desirous to know the history of the organization. The Society was organized in 1924 and incorporated in 1925. The first meeting was held in Washington, D. C. in 1924 with the American Association for the Advancement of Science. The first President was Dr. L. J. HENDERSON with Dr. J. H. BREASTED and FLORIAN CAJORI as Vice-Presidents. The same officers were re-elected for 1925. The second President was Dr. J. H. BREASTED with Dr. DAVID EUGENE SMITH and Dr. L. J. PAETOW as Vice-Presidents (for 1926). The third President was Dr. DAVID EUGENE SMITH with Dr. EDGAR F. SMITH and Dr. LYNN THORNDIKE as Vice-Presidents (for 1927). The fourth President was Dr. EDGAR F. SMITH with Dr. J. C. MERRIAM and J. H. ROBINSON as Vice-Presidents (for 1928). Dr. SMITH died in office and Dr. LYNN THORNDIKE was elected to fill the unexpired term.

February 15, 1929.

F. E. BRASCH.

ACCOUNT OF *ISIS* FOR THE YEAR 1928.

N. B. — This account does not refer to the numbers distributed to our members in 1928, nos. 33 to 36 (vols. 10 and 11; 36 is coming), a total of 1110 pages and 22 plates, but to the nos. which have been paid for in 1928, nos. 31 to 35, a total of 1140 pages and 18 plates. It will be easily seen that this does not make much difference.

<i>Expenditures.</i>		<i>Receipts.</i>	
Printing and mailing	2539.56	H.S.S.	1672
Brussels office	326.07	Sale of back vols. (1)	762
Cambridge office	344.77	Belgian subscriptions	133.76
Royalties	41.95		
Advertising	65.00		<hr/> 2567.76
	<hr/>	(1) Brussels, 637	
	3317.35	Washington, 125	
Printing cost per page (including plates)			2.23
Total publishing cost per page (including plates)			2.91
Of this total, 1.47 was paid by the H. S. S.,			
1.44 by the Editor			

Or, in other words, H. S. S. paid for 574 p., 9 pl.
 Editor paid for 566 p., 9 pl.

It may be observed that the Editor is not a man of means. He has no income but the very modest one which he and his wife earn by their own labor.

Cambridge, Massachusetts
January 6, 1929.

GEORGE SARTON.

FIFTH ANNUAL REPORT OF THE TREASURER AND COR-
 RESPONDING SECRETARY OF THE HISTORY OF SCIENCE
 SOCIETY... ENDING DECEMBER 31, 1928.

Total membership for the ending 1927	577	
members admitted for the year 1928	76	
	653	
Lost by death, resignation etc.	33	
Total including foreign	620	Total beginning 1929 .
Foreign	86	(paid to M. Guinet)
Domestic etc.	534	
Paid membership	354	For 1928
Unpaid »	180	

Total paid membership for 1928	354
Total paid membership for 1926 and 1927	64

Cash received from total paid membership \$ 2090.00

Cash received from full sets (ISIS)	125.00	Dartmouth \$ 40.00
	\$ 2215.00	Colorado 20.00

		Academy of M20.00
Royalty from Newton Memorial		Minnesota 25.00
less nine copies bought	73.00	Dr. Smith 20.00

Total cash received for 1928	\$ 2288.00	\$ 125.00
		Cambridge 40.00
		(not paid)

Total expenses as follows

Printing	\$ 162.00
Filing cabinet	8.25
Extra typing and translating	101.50
Railroad fares to Balt. Phil. N.Y.	65.00
Newton reprints	34.40
Nine volumes of Newton Memorial	27.00
Stamps and telegrams (exchanges)	57.00

Honorarium	100.00
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Dr. Sarton for <i>Isis</i>	1400.00
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	\$ 1955.15
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Dr. Sarton for <i>Isis</i> on 1927 acc.	499.00
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Balance in Bank	\$ 579.27
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\$ 2454.15	Total cash received	2288.00
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Total expenses	2454.15
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Balance for 1928	\$ 413.12
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Total from dues for Dr. Sarton	\$ 1672.00
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Total paid to date to Dr. Sarton	1400.00
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Balance due for 1928	\$ 272.00
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Sale of ISIS	125.00
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\$ 397.00

Library of Congress

Washington D. C.

FREDERIC E. BRASCH.

Fourth List of Members of the History of Science Society**.

elected from August 1, 1927, to December 31, 1928

- ADAMS, CHARLES W., M. A. Schoolmaster, Haileybury College, Hertford, England. 1927.
- ADAMS, FRANK D., D. Sc., F. R. S., Emeritus Vice-Principal, McGill University, Montreal, Canada. 1928.
- BALTA, J., Professor, School of Mines, Box N^o. 151, Lima, Peru, South America. 1929.
- BARROW, JOHN V., M. D., Physician, 142 South Windsor Blvd., Los Angeles, Calif., U. S., 1928.
- BARTLETT, ETHEL L., Ph. D. Head of Chemistry Department, Illinois Woman's College, Jacksonville, Illinois, U. S. 1928.
- BEAR, ORMOND W., Ph. D., Professor in Mathematics. Marquette University, Milwaukee, Wis., U. S. 1928.
- BEARDSLEY, E. J. G., M. D., Physician, 1919 Spruce Street, Philadelphia, Penn, U. S. 1928.
- BOLOGA, VALERIU, L., Sous-Directeur de l'Institut d'Histoire de la Médecine de l'Université, Cluj, Roumanie, 1928.
- BUNKER, Jr., HENRY A., M. D. Physician, 29 Fifth Avenue, New York, N. Y., U. S. 1928.
- CAMAC, C. N. B., A. B., M. D., Assist. Prof. Clinical Medicine, College of Physicians and Surgery, Columbia University, New York, N. Y., U. S. 1928.
- CARR, PAUL R., Bookseller, 3923 Packard Street, Long Island City, N.Y., U. S. 1928.
- CHAO, YUEN REN, Professor, Tsing Hua University, Peking, China. 1928.
- CHITTENDEN, ARTHUR S., M. D. Surgeon-in Charge, Binghamton City Hospital. Binghamton, New York, U. S. 1928.
- CLARKE, ELBERT H., Ph. D. Professor of Mathematics. Hiram College, Hiram, Ohio, U. S. 1928.

** For the previous lists, see *Isis*, 7, 371-93, 1925; 9, 7-10, 1927; 10, 7-10, 1928.

- CORIAT, ISADOR H., M. D., Physician, 416 Marlborough Street, Boston, Mass., U. S. 1928.
- COX, RICHARD T., Assistant Professor of Physics, New York University. New York, N. Y., U. S. 1928.
- DATTA, BIBHUTIBHUSAN, D. Sc., P. R. S., Lecturer in Applied Mathematics University of Calcutta. Calcutta, India. 1928.
- DAWSON, PERCY M., M. D. Assoc. Prof. Medical School and Adviser in Exper. College, University of Wisconsin, Madison, Wisconsin, U. S. 1928.
- DEGRANGE, MCQUILKIN, Ph. D. Department of Sociology, Dartmouth College, Hanover, N. H., U. S. 1927.
- DICKERSON, G. K., M. D., Physician, 280 Montgomery Street, Jersey City, N. J., U. S. 1928.
- DRAPER, GEORGE, M. D. Assistant Professor of Clinical Medicine, Columbia University, 33 East 68 th Street, New York City, N. Y., U. S. 1928.
- DRECKER, JOSEF, Professor, Westfall 33, Dorsten in Westfalen, Germany, 1928.
- DUNNINGTON, GUY W., Assistant Professor, Washington and Lee University, Lexington, Va., U. S. 1927.
- ELSEY, HOWARD M., Ph. D., Research Chemist, Westinghouse Electric and Manuf. Co., Research Laboratory, Ardmore Boulevard, East Pittsburgh, Penn., U. S. 1929.
- EVANA, Miss ERNESTINE, c/o Coward McCann, Publishers, 425 Fourth Avenue, New York, N. Y., U. S. 1928.
- FELDDHAUS, FRANZ MARIA, Dr.-Ing. h. c. Historiker der Technik, Sachsenring 26/27. Berlin-Tempelhof, Berlin, Germany. 1928.
- FORBES, ALEXANDER, Associate Professor of Physiology, Harvard Medical School, Milton, Mass., U. S. 1928.
- FRIEDENWALD, HAR. M. D., Prof. of Ophthalmology, University of Maryland, Baltimore, Md., U. S. 1928.
- FULTON, JOHN F., M. D., Physician, 29 Charlbury Road, Oxford, England. 1928.
- GANGULI, SARADAKANTA, M. A., Professor of Mathematics, Ravenshaw College. Cuttack, India. 1928.
- GAY, EDWIN F., Ph. D., Professor of Economic History, Harvard University, Cambridge, Mass., U. S. 1928.
- GEDDES, PATRICK, Director of College des Ecossais, Montpellier, France. 1928.
- GRAUSTEIN, WILLIAM C., Ph. D., Assoc. Prof. of Mathematics, Harvard College, Cambridge, Mass., U. S. 1928.
- HILL, JULIAN W., Graduate Student, 3654 Shaw Street, St. Louis, Mo., U. S. 1928.

- HOEBER, PAUL B., Medical Publisher, 76 Fifth Avenue, New York, N. Y., U. S. 1928.
- KALLERT, ELLIS, M. D., Physician Schenectady Hospital, Schenectady, N. Y., U. S. 1929.
- KELLY, T. HENSHAW, M. D., Physician, 490 Post Street, San Francisco, Calif., U. S. 1928.
- KOKOMOOR, F. W., Assistant Professor of Mathematics, University of Florida, Gainesville, Florida, U. S. 1928.
- LAKE, KIRSOPP, Ph. D., Winn Professor of Ecclesiastical History, Harvard University, Cambridge, Massachusetts, U. S., 1928.
- LEAVITT, JULIAN, R. D. 42, Norwalk, Conn., U. S., 1928.
- LOWES, JOHN L., Professor of English, Harvard University, Cambridge, Mass., U. S. 1928.
- MCCRACKEN, ROY, Ph. D., Research Chemist, 210 West 17th Street, Wilmington, Delaware, U. S., 1929.
- McKIE, DOUGLAS, Assistant in the Dept. of History, Methods and Principles of Science, University College, University of London, London, England, 1928.
- MACPIKE, EUGENE FAIRFIELD, Research Scholar, 5418 Woodland Ave., Chicago, Ill., U. S. 1929.
- McTAVISH, W. C., Ph. D., Prof. of Chemistry, New York University, New York City, U. S. 1928.
- MARKER, JAMES P. H., Hon., LL. D., Sc. D. Ph. D., 357 Ninth Street, Brooklyn, N. Y. U. S. 1928.
- MAROTTE, FRANCISQUE, Prof. au Lycée Charlemagne, 35 bis, rue de Reuilly, Paris, 12^e. 1928.
- MEANY, EDMOND S., Ph. D., Professor of History, University of Washington, Seattle, Wash., U. S. 1928.
- MERRIMAN, ROGER B., Ph. D. Professor of History, Harvard University, Cambridge, Mass., U. S., 1928.
- OLIVER, JOHN R., M. D., Professor of History of Medicine, University of Maryland, Baltimore, Md., U. S. 1929.
- PARTRIDGE, EDWARD A., Head of Dept. of Science, West Phila. High School, Philadelphia, Pennsylvania, U. S. 1927.
- PATTERSON, THOMAS S., Ph. D., Professor of Organic Chemistry, University of Glasgow, 89 Oakfield Ave., Hillhead, Glasgow, Scotland, 1929.
- PORTER, A. KINGSLEY, Ph. D., Boardman Professor of the Fine Arts, Harvard University, Cambridge, Mass., U. S. 1928.
- PRIEST, IRWIN G., Ph. D., Physicist, U. S. Bureau of Standards, Washington, D. C., U. S. 1928.
- RAND, EDWARD K., Ph. D., Professor of Latin in Harvard University, Cambridge, Mass., U. S. 1928.

- REICH, NATHANIEL, Ph. D., Professor of Egyptology and Orientalistics, Dropsie College, Philadelphia, Penn., U. S. 1928.
- RUSKA, JULIUS, Dr. Director, Forschungs-Institut für Geschichte der Naturwissenschaften, Schloss, Portall 19, Berlin, C 2, Germany. 1928.
- SALANT, WILLIAM, M. D., Medical Department, University of Georgia, Augusta, Ga., U. S., 1929.
- SMITH, WILBUR M., D. D., Presbyterian Minister, 421 Riverside Avenue, Covington, Va., U. S. 1927.
- SNEIDE, OLE J., 118 Sixth Avenue, San Francisco, California, U. S. 1927.
- SPINDEN, HERBERT J., Ph. D. Peabody Museum of American Archaeology and Ethnology, Harvard College, Cambridge, Mass., U. S. 1928.
- STILLWELL, MARGARET B., M. A., Librarian and Curator, The Annmary Brown Memorial, Providence, R. I., U. S. 1928.
- STROHL, JEAN, Ph. D. Prof. of Zoology, University of Zurich, Switzerland. 1927.
- THOMSON, ELIHU, Ph. D., Sc. D., Consulting Engineer, 22 Monument Avenue, Swampscott, Mass., U. S. 1928.
- THORNTON, FRANCIS E., M. D., Physician, 2524 Kimball Avenue, Chicago, Ill., U. S. 1928.
- TORY, Dr. H. M., Ph. D., President, National Research Council, Ottawa, Canada. 1928.
- VAISH, M. A. H. Bayley Sarai Street, Biharsharif Behar, India, 1928.
- VOYNICH, WILFRID M., Ph. D., Rare-Book Dealer, 33 West 42 nd. Street, New York, N. Y., U. S. 1929.
- WALCOTT, Gregory Dexter, Ph. D., Professor of Philosophy. Long Island University, Brooklyn, N. Y., U. S. 1928.
- WEINBERGER, BERNHARD W., M. D., Practising Orthodontist, 119 West 57th Street, New York, N. Y., U. S. 1929.
- WILLIAMS, KENNETH P., Ph. D. Professor of mathematics, Indiana University, Bloomington, Indiana, U. S. 1928.
- WRIGHT, LOUIS T., M. D., Physician, 218 West 139th Street, New York City, U. S. 1928.
- ZILBOORG, GREGORY, M. D., Neuro-Psychiatrist, Bloomingdale Hospital, White Plains, N. Y., U. S. 1928.

Institutional Members

- American Geographical Society. Library. Broadway at 156th Street, New York City, N. Y., U. S. 1928.
- Bibliothek Warburg, Hamburg, Germany. 1928.
- Dartmouth College Library. Hanover, New Hampshire, U. S. 1927.
- George Washington University Library. (Dr. A. F. W. Schmidt, Librarian) Washington, D. C., U. S. 1929.

- Instituto-Escuela, calle del Pinar, 21, Madrid, Spain. 1928.
Municipal Library. Salah Ed Din Post Office, Alexandria, Egypt. 1928.
Skidmore College Library, Saratoga Springs, N. Y., U. S. 1928.
Stanford University Library, Stanford University, Calif., U. S. 1928.
U. S. Army Medical Library. 7th and B Street, S. W. Washington,
D. C., U. S. 1928.
Universitätskasse, Kiel, Germany. 1927.
University Library, Cambridge, England. 1928.
University of Colorado Library. Boulder. Colorado, U. S. 1928.
University of Michigan Library. Ann Arbor, Michigan, U. S. 1928.
University of Minnesota Library. Minneapolis, Minn., U. S. 1928.
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The Introduction of Arabic Science into Lorraine in the Tenth Century

« Down to the twelfth century the share of Christian Spain in the diffusion of Saracen learning seems to have been small..... In general, the lure of Spain began to act only in the twelfth century..... [But] the discovery of evidence from the tenth century (984) requires a reopening of the question » (1)

It is the purpose of this brief article to show that : (1) the intellectual avenue between Spain and Europe beyond the Pyrenees, which was as old as the Roman Empire, was never wholly closed ; (2) Arabic science was introduced into the schools of Lorraine and was cultivated there before GERBERT. So far as I am aware, when and how Arabic science first found its way into Lorraine has not yet been explained, although other scholars before professor HASKINS have recognized the eminence of Lotharingian churchmen of the eleventh century in mathematics and astronomy (2).

The intellectual nexus between Spain and Gaul which was close in imperial times, was not broken by the barbarian invasions. On the contrary, the fact that for nearly a century the Visigothic domination prevailed on both sides of the Pyrenees cemented that relation the more, and the intellectual relation between the two countries continued on through the sixth, seventh and eighth centuries.

(1) HASKINS, *Studies in the history of mediæval science*, 8-9 and note 20.

(2) Professor HASKINS, differing from Mr. REGINALD LANE POOLE, associates the introduction of the abacus into England « with the movement which connected England with the schools of Lorraine », *op. cit.* 333. Elsewhere, writing of the treatise on the astrolabe, ascribed to GERBERT or HERMANNUS CONTRACTUS and containing numerous Arabic words, Professor HASKINS remarks that evidently « an acquaintance with this instrument had in some unknown way passed into Latin Europe in the course of the eleventh century », *op. cit.* 115. The present article, I think, shows the probability that this knowledge took root in Lorraine in the middle of the tenth century.

The history of the three oldest Mss. of the Vulgate casts some light on this matter. Professor E. K. RAND, in his masterly critique of DOM QUENTIN's memoir on the text of the Vulgate ⁽³⁾, has shown that « the entire tradition depends on three ancient books » : the *Ottobonianus* (saec. VII), the *Turonensis* (saec. VII) and the *Amiatinus* (saec. VII). There is a Spanish group, a Cassinian group and an Italian group of Vulgate Mss. derived from these parent texts. But in as much as the Cassinian group is derived from a Spanish text, and « the leader of the Spanish group is the *Turonensis* » ⁽⁴⁾, it is apparent that Spanish tradition in regard to the Vulgate Mss. is predominant ⁽⁵⁾. ALCUIN's own edition of the Vulgate was derived from *Amiatinus*, the famous codex which was brought from Italy to Northumbria and returned again to Italy. ALCUIN knew the *Ars grammatica* of JULIAN OF TOLEDO (ca. 680-87), which was also known earlier to BEDE and ALDHELM ⁽⁶⁾.

Spanish influence north of the Pyrenees was stimulated by CHARLEMAGNE's conquest of the territory north of the Ebro, and its union with the Frank Empire. Spanish churchmen like THEODULF OF ORLEANS and CLAUDIUS OF TURIN were less distinguished representatives of the Carolingian renaissance than ALCUIN ⁽⁷⁾. There is no trace of any Spanish scholar at the court of CHARLES THE BALD (840-77), but MARTIN OF TOLEDO's « Lecture Notes » enjoyed considerable influence and popularity in the schools of Gaul in the ninth century. Fragments of them are found in

(3) *Harvard Theological Quarterly*, XVII, 212.

(4) *op. cit.* 212.

(5) In the reign of CHARLEMAGNE, THEODULF, bishop of Orleans and a native of Spain, prepared an edition of his own of the Vulgate. According to BERGER, THEODULF had a now lost Spanish text before him (*Theta*); according to DOM QUENTIN this text was *Ottobonianus*; according to professor RAND the theory that *Ott.* is the immediate ancestor of *Theta* cannot be sustained. He thinks that THEODULF possessed « a copy of some Spanish form of text not derived directly from *Ott.* but related to it », *op. cit.* 236.

(6) BEESON, *Miscellanea Franz Ehrle*, Rome, 1924.

(7) I have elsewhere in two articles shown the large interest of the Frank Empire in Spain during the reign of LOUIS THE PIOUS (814-40) — « The origin of the word Goliardi », *Studies in philology* XX, 83-98; « The manuscripts of EINHARD's Vita Karoli », *Mélanges Henri Pirenne*, 519-32. And for the commercial relations between the Frank Empire and Mohammedan Spain see my *Economic and social history of the middle ages*, 236-37, 258-59.

a tenth century manuscript written in Spain, and in a Bodleian manuscript of about the same date ⁽⁸⁾.

Additional evidence of close intellectual relation between Frank Gaul and Spain is found in the history of the scriptorium of Lyons ⁽⁹⁾. An unusual number of these Mss. at Lyons are of Spanish origin, and apparently a cluster of Spanish monks or clerics was dwelling at Lyons in the ninth century ⁽¹⁰⁾. The pro-symbol for *per*, which is common in Frank charters of the eighth century « constitutes a permanent feature of the script » of Visigothic Mss. ⁽¹¹⁾. There is also evidence of the tenacious survival of Visigothic palaeographical peculiarities ⁽¹²⁾. In Plate XXII (ninth century) « the hand is contemporary with the Visigothic, and seems to labour directly under its influence. Possibly the exemplar was Visigothic » ⁽¹³⁾. Plate XXIV is taken from the famous Ms. of the Code of the Visigoths-*Lex Romana Visigothorum*) although the Ms. itself is of Frank execution.

Furthermore, it must not be forgotten that PRUDENTIUS, bishop of Troyes and the first of the three compilers of the *Annales S. Bertiniani* (835-61) was a Spaniard. Under the year 858 he informs us that a certain monk from the monastery of ST. VINCENT the Martyr in Cordova came into Gaul bringing with him the relics of three Spanish martyrs ⁽¹⁴⁾. In 864 CHARLES THE BALD sent two ambassadors to the khalif of Cordova, who returned to Compiègne in the following year « cum multis donis, camelis videlicet,

(8) LEISTNER, « The revival of Greek in western Europe in the Carolingian age », *History*, October 1924, 184.

(9) See TAFEL, « The scriptorium of Lyons » in LINDSAY, *Palaeographica Latina*, II, 66 f. and especially E. A. LOWE, *Codices Lugdunenses antiquissimi*, Lyons 1924

(10) LOWE, *op. cit.* 16.

(11) LOWE, *op. cit.* 33.

(12) LOWE, *op. cit.* Plate XXI, p. 39 is a Visigothic hand of the ninth century. « We probably have here the work of a Spanish-trained cleric whose native peculiarities have been rubbed away by a sojourn at Lyons ».

(13) LOWE, *op. cit.* 39.

(14) AIMON OF ST. GERMAIN DES PRÉS (died 896) was the author of two works commemorating this event : *Historia translationis S. Vincentii ex Hispania in Castrense Galliae monasterium* (855), written in prose and verse. WINTERFELT, *Poetae Latini* IV, 138-40, has published a good edition of the text. But there is not even a good text of his other work : *De translatione SS. martyrum Georgii monachi, Aurelii et Nathaliae ex urbe Corduba*, MIGNE, *Pat. Lat.* CXIV, 939-60. Neither of these works has been carefully studied for information on intellectual relations between Spain and France before GERBERT's time.

lecta et papiliones gestentibus, cum diversi generis pannis et multis odoramentis ⁽¹⁵⁾.

This traditional relation of the Carolingians with Spain survived on into the tenth century. The archives of Barcelona contain 45 Carolingian charters between the years 930 and 961, and those of Vich have 13 more ⁽¹⁶⁾. In the residue of the tenth century France's contact with Spain diminished, and was not resumed until the inception of the Spanish crusades.

It is admitted that this evidence is not large for the intellectual relations between France and either Christian or Mohammedan Spain in the ninth and tenth century. Yet ideas follow trade and courier routes.

We are on solid ground when we inquire into the relation between Saxon Germany, i.e. Germany in the reign of OTTO THE GREAT (936-73) and Mohammedan Spain. WIDUKIND the Saxon chronicler of the time enumerates a long list of oriental importations brought into Germany from Saracen lands. He does not specifically say from Spain; but we know from other evidence that some of these wares came from the western khalifate ⁽¹⁷⁾. LIUTPRAND's *Antapodosis* was written at the request of RECEMUNDUS, bishop of Elvira, who was sent as an ambassador to OTTO I in 956 by the khalif ABDERRAHMAN III, and whom LIUTPRAND met when the German court was at Frankfort ⁽¹⁸⁾. It was doubtless from the bishop that LIUTPRAND learned of the victory of RAMIRO II of Leon over the Mohammedans in 939 ⁽¹⁹⁾,

(15) *Annal. Bertin*, 865. We may supplement this evidence by a charter of CHARLES THE BALD of the year 859 for Aureolus, the original of which is preserved in the archives of the duke of Medinaceli, caja 3A. See CALMETTE, *La diplomatie Carolingienne*, 63, note 3.

(16) LAUER, *Le règne de Louis d'outremer*, 305-11.

(17) ...diversi generis munera, vasa aurea et argentia, aerea quoque et mira varietate operis distincta, vitrea vasa, eburnea etiam et omni genere modificata stramenta, balsamum et totius generis pigmenta, animalia Saxonibus antea invisita, leones et camelos, simias et strutoines, WIDUKIND, *Rerum gestarum saxonicarum*, III, 57. Cf. G. JACOB, « Arabische Berichte von Gesandten an German. Fürstenthöfe », *Quellen z. deutsch. Volkskunde* (1927), Heft 1.

(18) J. BECKER, *Die Werke Liutprands von Cremona*, Einleitung, VIII-IX (1915). On ABDERRAHMAN III see A. MULLER, *Der Islam im Morgen- und Abendland* (Berlin, 1887). II, 96 f.; G. DIERCKX *Geschichte Spaniens*, I, 259, f. (Berlin 1894).

(19) SCHAFER, *Gesch. von Spanien*, II, 183 f.; MULLER, *op. cit.* II, 522; DOZY, *Histoire des Musulmans d'Espagne*, II, 39.

and of that astonishing raid of the Hungarians into the peninsula early in the tenth century, of which the Arabic historian MAS'UDI has made mention ⁽²⁰⁾.

This diplomatic visit of the bishop of Elvira to Germany was the Spanish khalif's reply to an embassy which OTTO I had dispatched to Mohammedan Spain three years before. In these times the Saracens were not only in occupation of almost all Spain and the whole of Sicily, but also had extended their domination over Provence from Marseilles to Grenoble. Indeed, they had control of most of the Alpine passes, and even Piedmont and German Switzerland were ravaged by them. In addition, their corsairs terrorized the western Mediterranean, and time and again harried the seaboard cities of the Riviera ⁽²¹⁾.

Although OTTO I had not yet extended the German domination south of the Alps, he was deeply interested in Italian affairs, and hence in 953 determined to send an ambassador to Cordova with a view to abate the evil. His choice fell upon the monk JOHN of the monastery of Gorze near Metz in Lorraine ⁽²²⁾.

JOHN OF GORZE — he was not made abbot until 960-74 -- is a neglected figure in the intellectual movement of the tenth century. The monastery had been founded in the middle of the eighth century by CHRODOGANG OF METZ, but fell into decay in common with all monasticism, during the ninth century. In 919, as it was without walls, it was sacked by the Hungarians. GORZE's recovery began with the movement for monastic reform initiated

(20) ed. MARQUART, 150, 159.

(21) See SACKUR, *Die Cluniacenser*, I, 222-30; POUPARDIN, *Le royaume de Provence sous les Carolingiens*, 243-73; KELLER, « Der Einfluss der Sarrazen in die Schweiz », *Mittheil. der antiq. Gesellschaft in Zürich*, XI, 14.

(22) The Life of JOHN OF GORZE, *De vita Joannis abbatis Gorziensis*, was written soon after his death in 974 by his friend JOHN, abbot of St. Arnulf in Metz. It may be found in *MGH. SS.* IV, 337-47 and in MIGNÉ, *Patrologia Latina*, CXXXVII, 421-310. The best account of JOHN OF GORZE is in SACKUR, *op. cit.* I, 146-56; II, 358-61. See also STREBER, « Abt JOHANNES VON GORZE » in WETZER'S *Kirchenlexicon*, 2d ed. VII, 1684-86, and SCHULZE, « War JOHANNES VON GORZE historischer Schriftsteller? », *Neues Archiv*, IX (1884), 497-512. I have not seen MATHIEU, *Joannis abbatis Gorziensis vita* (Nancy, 1878). The history of Gorze has been written by LAGER: « Die Abtei Gorze in Lothringen. » *Studien und Mittheilungen aus dem Benedict- und Cisterc. Orden*, VIII (1887), 32-56, 181-92, 328-47, 540-74. The Ms. cartulary, still unpublished, is in Bibliothèque Nationale, No. 5436, of which a description may be read in CHAMPOLLION-FIGÉAC, *Documents inédits* II, cxiv Cf. SACKUR, *op. cit.* II, 127.

by GÉRARD OF BROGNE in Brabant in the first quarter of the tenth century, whence it spread into the Rhinelands and was promoted by BRUNO OF COLOGNE. Gorze became the chief seat of this activity, so much so that it is sometimes known as the Gorzean Reform ⁽²³⁾.

This moral restoration in Lorraine quickly led to an intellectual revival in the monasteries, of which Gorze became a leading light. Within its hospitable walls foregathered scholarly monks from Metz, Toul, Verdun, Burgundy, with now and then a visitor from England, Ireland, Scotland and Calabria ⁽²⁴⁾. In and around Metz in the middle of the tenth century was a congenial group of scholarly monks and clerics interested in mathematics and astronomy and music. Among them were SALECHO, a clerk of St. Martin's « ultra fluvium Mosellae », BANDINCUS, a priest of St. Symphorian « extra portam urbis meridinam », BERNACER, « skilled in calculation and music », who was a deacon of St. Stephen's, ROTLANDUS, cantor of the cathedral in Metz, WARIMBERTUS, a canon of the same church, and most remarkable of all, some nuns of a local convent among whom one, Sister GEISA, is named ⁽²⁵⁾.

It must have been a great day for this group when JOHN OF GORZE returned from a long journey which he and his friend BERNACER made to Italy, where they visited Rome, Monte Cassino, Naples — and viewed the smoking cone of Vesuvius with wonder — Mont Gargano, Benevento and Apulia ⁽²⁶⁾. From Lower Italy, which as every scholar knows, was at this time rich in Greek tradition and culture, JOHN brought back precious Mss. to Gorze,

(23) For details see my *Feudal Germany*, 57-62; SACKUR, *op. cit.* I, 150 f.

(24) Istuc congregavit de Graccia videlicet, Burgundia ac de penitus toto divisio orbe, Britannia, Mettensibus, Tullensibus, Verdunensibus — *Miracula S. Gorgonii*, c. 26 SS. IV, 246. Coetum quoque Grecorum ac Scottorum agglomerans non modicum propriis alebat stipendiis commixtum diversis linguæ populum — *Vita Gerardi episcopi Tullensis* (963-94), SS. IV, 486, c. 19; Nam Scotti et reliqui sancti peregrini semper sibi dulcissimi habebantur, *Vita Adalberonis II episcopi Mettensis* (984-1005), SS. IV, 659 f., c. 26; Cf. SACKUR, *op. cit.* I, 146-49; II, 358-62.

(25) *Vita Joannis Gorz.* caps. 17, 33, 41, 43, 52.

(26) There are allusions to this journey in *Vita*, caps. 24, 33, 38, 52. Perhaps JOHN and his friend also visited Salerno, where ODO OF CLUNY had stayed in 940, and where his *Vita* was written — SACKUR, *op. cit.* I, 337, 344, and in *Neues Archiv* XIV, 105. Here the ducal major domo, whose name was JOHN, was well known for his scholarly interests — *Vita Odonis*, prolog.; SACKUR, *op. cit.* I, 112, 359 note 2. On the school at Salerno see C. and D. SINGER, « The school of Salerno », *History*, Oct, 1925, 242 f.

among them ARISTOTLE's *Categories*, and PORPHYRY's *Isagogia* ⁽²⁷⁾. The Greek revival in Saxon Germany was not wholly due to the Byzantine wife of OTTO II and her protégé, JOHN OF CALABRIA.

Whether JOHN OF GORZE had picked up some knowledge of Arabic during his Italian journey we are not told. But certainly his experience as a traveller, his wide culture, made him the best qualified person for OTTO I to employ when he wished to send an ambassador to Cordova in 953. Unfortunately the *Vita* is not so full of information upon JOHN's journey into Spain as upon his travels in Lower Italy, and no Spanish chronicle supplements it like that of VOLTURNO. But two precious bits of information are vouchsafed. In Mohammedan Spain JOHN OF GORZE fell in with a Spanish Jew named HASDEU, who understood Latin, and of course was acquainted with Arabic ⁽²⁸⁾, and bishop RECEMUNDUS who was JOHN's guide and friend in the difficult negotiations with the khalifate, we are told, was « et litteris optime tam nostrorum quam ipsius inter quos versabatur linguæ Arabicæ institutus » ⁽²⁹⁾.

JOHN dwelt in Cordova in intimate association with these two men for nearly three years. It is not explicitly recorded, but it is impossible not to believe that a man of so much intelligence and culture, so deeply interested in mathematics and astronomy, brought back with him to Gorze from Cordova some Arabic Mss. of scientific nature, as he had formerly brought back similar Mss. from Lower Italy. ⁽³⁰⁾ Moreover, we are justified in inferring that JOHN OF GORZE acquired some knowledge of the Arabic language while in Spain from Spanish Jews who understood Latin.

(27) *Vita* caps, 24, 33; *Chron. Vulturn*, Muratori, SS. I, b, 422; Cf. SACKUR, *op. cit.* II, 358; HAUCK, *Kirchengeschichte Deutschlands*, III, 351; GIESEBRECHT, *Kaiserzeit*, II, 745, 779, 785 (5th. ed.); ABBO OF FLEURY, a little later than this — he died in 1004 — had an example of ARISTOTLE's *Categories*, SACKUR, *op. cit.* II, 345. The *Categories* and *Isagogia* were both in the library of Montier-en-Ider when ADSO was abbot there (died 992). SACKUR, *op. cit.* II, 362. The catalogus which he compiled has been published by OMONT, *Bib. de l'École des chartes*, 1882, p. 157 f.

(28) *Vita*, c. 121. On Spanish Jews who understood Latin see DOZY, *Recherches*, I, 87; LAGER, *op. cit.* 189-92.

(29) *Vita*, c. 128.

(30) One wonders, in this connection, whether GERBERT may not later have got some Arabic scientific Mss. from Gorze. For he was forced to flee from France in the spring of 997, and OTTO III gave him the domain of Sasbach near Strasburg, whence he wrote a letter in behalf of count HERMANDUS, probably HERMANN

While we lack positive evidence of the pursuit of Arabic science in the schools of Lorraine in the years immediately following JOHN OF GORZE's return from Spain, the constructive evidence points to it, and inverse reasoning affirms it. How else are we to explain the fact that « Lorraine... in the eleventh century was the chief centre for the study of the abacus, and produced such eminent mathematicians as HERIGER OF LOBBES, ADELBOLD OF UTRECHT, REGINALD OF COLOGNE, and RALPH and FRANCO OF LIÈGE »? ⁽³¹⁾ Or how else can we account for the transmission of Arabic learning across the Channel into England in the persons of ROBERT DE LOSINGA, who became bishop of Hereford, WALCHER OF MALVERN, WALCHER OF DURHAM, THOMAS OF YORK and SAMSON OF WORCESTER? ⁽³²⁾

I am convinced that the schools of Lorraine in the last half of the tenth century were the seed-plot in which the seeds of Arabic science first germinated in Latin Europe, from which the knowledge radiated to other parts of Germany — witness HERMANN CONTRACTUS in Reichenau — to France, and especially, owing to the preference of KNUT THE GREAT for Lotharingian churchmen, into England.

And yet, until ADELARD OF BATH, Arabic learning was still so little cultivated in western Christendom that GUIBERT DE NOGENT could write: « Scientia scilicet astrorum quæ apud Occidentales tenuior extat et rarior, eo apud Orientales ubi et originum habuit, continuo usu ac frequenti memoria magis fervere cognoscitur » ⁽³³⁾ — a declaration remarkable both for its recognition of the value of the new learning and its tribute to the Arabs.

One word more: As all the world knows, knowledge of Arabic

a brother of ADALBERON, bishop of Verdun, who was being warred upon by THIERRY count of Metz and duke of Upper Lorraine — See LOT, *Hugues Capet* 290, 291, 294; *Lettres de Gerbert*, ed. HAVET, No. 182. That GERBERT at this time was interested in mathematics is shown by his *Ep.* 186 to OTTO III in which he writes that he is sending him a copy of BOETHIUS' *Arithmetic*. This Ms. is probably identical with that now in Bamberg library, HJ. IV, 12, apparently written in the tenth century. Did it originate at Gorze?

(31) HASKINS, *op. cit.* 334.

(32) On all these see HASKINS, *op. cit.* 334. The last two were not natives of Lorraine but received part of their education in Lotharingian schools.

(33) *Recueil des croisades*, Hist. Occident, IV, 246. Cf. III, 814; IV, 193.

science increased by leaps and bounds during the latter half of the twelfth century. In this development the great monastery of Cluny may have had a part which has not been appreciated. ODO OF CLUNY wrote a *Compotus* and many works on music, some of the information in which may have been drawn from Arabic sources which were made available for him in Latin translation when he was at Salerno ⁽³⁴⁾. But quite apart from this, Cluny was the great promotor of the Spanish Crusades in the eleventh century ⁽³⁵⁾ and its library, although the catalogue gives us no clear information to that effect, must have profited by the acquisition of Spanish and Arabic Mss. ⁽³⁶⁾. The fact that PETER THE VENERABLE, ca. 1150 sponsored a Latin translation of the Koran is further evidence of Cluny's interest in Arabic knowledge. Spanish monks were so numerous at Cluny in the eleventh century that the Spanish rite was regularly celebrated there ⁽³⁷⁾.

(Chicago).

JAMES WESTFALL THOMPSON.

P. S. — The Jewish communities in Lyons, Marseilles and Bordeaux in the ninth century, and later, were in commercial relation with Spain, Italy and the Orient. This is especially true of the Jews of Lyon. AGOBARD of Lyons (died 840) in his polemical tract, *De insolentia Judaeorum* (*), protested against the coming and going of Spanish Jews between Spain and the Frank kingdom; and this evidence is sustained by other sources (**). The history of art in the Middle Ages also contributes to this information. For M. EMILE MÂLE in his recent and fascinating work,

(34) Mr. HENRY G. FARMER, "The Arabian influence on musical theory", *Journal Royal Asiatic Society*, Part I (1925) makes no mention of ODO OF CLUNY as a writer upon music, yet his writings on this subject are voluminous. They are to be found in MIGNE, *Pat. Lat.* CXXXIII.

(35) See SACKUR, *op. cit.* II, 101-13; BOISSONADE, *Du nouveau de chanson de Roland*.

(36) See DELISLE, *Catalogue des manuscrits*, II, 499 f. For Cluny's share in the loot of the Saracens in Spain see RODOLFUS GLABER, *Historiarum Libri*, ed. PROU, bk. IV, cap. 7, p. 101. Cf. SACKUR, *Neues Archiv*, XIV, 405 and his *Die Cluniacenser*, II, 112.

(37) ROD. GLABER, *op. cit.* III, 3, p. 62.

(*) MIGNE, *Pat. Lat.* CIV. Cf. AGOBARDI, *Epist.* 4, 6, 7, 8, 9, 10 : MGH. *Epist. Merov. et Karol. ævi*, III.

(**) MGH. *Formule*, ed. ZEUMER, 309, 325. Cf. ARONIUS, *Die Regesten zur Geschichte der Juden... bis zum 1273*, 81, 82.

L'Art et les artistes du moyen âge (1927), in two chapters entitled « Mosquée de Cordoue » and « L'Espagne arabe et l'art roman » has made a comparative study of the monuments north and south of the Pyrenees, which opens a new horizon. He shows that relations between Christian France and Mohammedan Spain were more frequent and more intimate than we have hitherto believed. He cites much evidence for the presence of monks at Cordova in the ninth century; Cluniac monasteries in Aragon, Castille, Leon; a French quarter at Toledo; and more astonishing, Spanish Arabs sending presents to the Virgin of Puy. The cathedrals of the Midi were situated upon routes followed by thousands of pilgrims and borrowed architectural motifs from the mosques of the Peninsula.

J. W. T.

The Jew HASDEU mentioned in the text might be identical with the great ḤASDAI IBN SHAPRUT, who died in 970 or 990 at Cordova. See my *Introduction* (vol. 1, 680). It is true the name ḤASDAI was not uncommon in Jewish Spain.

G. S.

A Fifteenth Century French Algorithm from Liège.

THE MANUSCRIPT. Ms. 10457-62 of the Bibliothèque Royale at Brussels contains an algorithm in French verse which has not hitherto been published. In the printed catalogue (1), where the Ms. is numbered 6513, particulars will be found of the other contents of the volume, the principal being the Chronicle of JEAN DE STAVELOT (fo. 4-164) (2), *Li Patron del Temporaliteit* by JACQUES DE HEMRICOURT (fo. 165-190), *Le Miserere* by the RENCLUS DE MOILIENS (fo. 194-210), and *Le Codicile* attributed to JEAN DE MEUNG (fo. 214-233). The whole volume is in the same handwriting, that of the indefatigable calligrapher, compiler and chronicler JEAN DE STAVELOT (1388-1449), a monk in the Benedictine Abbey of St. Laurent near Liège (3). Statements made by the scribe on fo. 4 and 154 inform us that the portion of the volume contained between these folios was compiled during the years 1440-45; the remainder of the volume was therefore written between 1445 and the scribe's death in 1449. The algorithm, which is written in columns of verse, two columns to a page, 51 to 54 lines to a column, occupies fo. 210b to 212c. A brief prose heading occupies the last five lines of col. 210a. Col. 212d is blank. The large initial G (in error for Λ) in v. 1, occupying a height of four lines, is red ornamented with blue. There are large blue or red initials also, each two lines high, at vv. 37, 69,

(1) *Catalogue des Manuscrits de la Bibliothèque Royale de Belgique*, IX, par J. VAN DEN GHEYN et E. BACHA, Brussels, 1909, p. 293.

(2) Edition by A. BORGNET, *Chronique de Jean de Stavelot* (Collection de Chroniques belges inédites), Brussels, 1861.

(3) See F. DE REIFFENBERG, in *Annuaire de la Bibliothèque Royale de Belgique*, I, 1840, pp. 49 ff.; E. GACHET, in *Compte-rendu des séances de la Commission Royale d'Histoire*, first series, XIV, Brussels, 1848, pp. 165 ff.; A. DINAUX, *Trouvères, Jongleurs et Ménestrels...*, IV, Paris and Brussels, 1863, pp. 439 ff.; G. GRÖBER, *Grundriss der romanischen Philologie*, II, 1, Strassburg, 1902, pp. 1174 f. GACHET, *op. cit.*, p. 185, quoted vv. 1-7, 37-43 and 46-51 of the algorithm.

de cele obscure bale ymenage
 En cel monde et par espart
 sans nos ours a nous ses ombage
 fache a fache non par ymage
 En fil beaur en manastert
 Or parot dien nre signour
 dms par sa grace & digne amour
 nos dms les bies fme & entede
 et bms en si loral labour
 por mngier de pain de sanour
 Et en bms nos bies despadre
 ouquelle luffier & a dieu pndre
 les bies as bms sans repndre
 por nos pechies sct en tndre
 Et la cheu estier & qvndre
 En che fiede por nos despadre
 del permanable tenebrour
 Et le moine qui ne descluse
 dny de dieu fme mlt sones che
 prie a tous cheus q le honte
 dms casoy deap si bay y muse
 dms bmes pndre por vusa
 Et fache che que li dieu conta
 si q de la goulte par fonte
 prinu son amir de si laconte
 de dieu qui mille ne de refuse
 si fparat a quelle grt honte
 Et li fover malvais reconte
 por de dieu nras de sabuse
 Et dphne ly dieu par apndre
 la pntone son amne fubcur
 Et ly mander a bone bore
 Ofens par bay en cec & plm
 an mors valloist leudemain
 del sans fme qe & mangier
 Et content pppm bies

En apres sentier la noble et
 subtile science qui est appellee
 le compte de algorisme pnt
 que dieu qui le fist auoir nom
 algorisme qui estour bnd pnt

Algorisme si esty noble
 qui brisande qe & merce noble
 chapt & corce & tamenet
 qui en mlt fur dny ne mlt
 dny mlt subre est renomies
 Et si est auterement nomies
 ly nombre de arismetique
 del science arismetique
 desquies et celle qui par dny
 que ons appelle de la bagne
 les tres nobles ensement
 Et che a comen appent
 Et a nobre le le jomure
 de 10 et la cyfre figure
 Et implier sans de laure
 luy de qte tot ym laura
 Et dny & dny & dny
 Et luy de laure en si fme
 che est bnd mlt noble science
 qui le redout en sa qvndre
 si la tndre en hnt dny
 Se li subreant a pnt
 Si dny et foy assenon
 dny algorisme bnd fme
 Si encande dny dny fme
 por fme et le mlt fme
 En apres mlt en la fme
 On cel tndre pndre sa fme
 Car tout le que mlt fme
 dny le pnt bnd auon
 Et fme le bnd bnd recenir
 bnd fme dny fme pnt
 mlt de apres et tout lant
 dms vnt co pnt pnt
 Si co dny apres dny bnd
 Et dny bnd le pnt fme

Li mlt plus q 10 figure
 Et la cyfre par l'homme
 dny fme tndre ensemble 10
 dny lnt dny en si que se dnt
 0 1 2 3 4 5 6 7 8 9
 A recenir le dnt ons lnt
 En si co li pnt escrive
 dny dnt qui ymmer le troua
 pnt fme tout la fme
 En si comp ons amonant
 la plus grt fme pnt fme
 En si la fme dny fme
 fme mlt plus q les dnt fme
 mlt de che fme tout dnt
 En ymmer a la bone main

104, 138, 168, 204, 230, 268, 306, 342, 370, 417 and 455. The other lines begin with a small capital or an ordinary letter containing a vertical red stroke. I am indebted to Professor L. C. KARPINSKI for supplying me with rotographs of the pages here concerned.

CONTENTS. The poem, as preserved, consists of 496 octosyllabic lines; but short passages appear to be missing after vv. 62, 65, 77, 149, 169, 176, 379, and perhaps elsewhere. A prologue (vv. 1-36) explains the meaning of algorism, its utility, and the advantages to be derived from a thorough knowledge of the rimed version that is to follow. The treatise begins with an exposition of the use of the Arabic (here called Jewish) numerals (vv. 37-89) — how to write them and in what order, the effect of position on their value, and the writing of numbers beyond one thousand — followed by the usual definitions of digit, article and composite (vv. 90-103). After enumerating eight operations of arithmetic (vv. 104-113), the author goes on to deal with each of these operations separately : —

I. Numeration (vv. 114-117).

II. Addition (vv. 118-155).

III. Subtraction (vv. 156-203).

IV. Duplication (vv. 204-229).

V. Dimidiation (vv. 230-267).

VI. Multiplication, in two sections, (a) how to multiply one series of figures by another (vv. 268-303), (b) six rules for the inter-multiplication of digits, articles and composites (vv. 304-369).

VII. Division (vv. 370-432).

VIII. Progression, i.e. the totalling of arithmetical series (vv. 433-466). Of the nine methods announced in v. 439, only three are explained.

In a quaint epilogue (vv. 467-496) the author emphasizes the value of study and the inexhaustibility of learning. The divisions here adopted are not all indicated in the Ms.; but *Additio*, *Substratio* and *Progressio* have been written, in addition to paragraph signs, against vv. 118, 156 and 433 respectively. The plan of the work agrees fairly closely with that of the well-known treatise written about 1250 by JOHN OF HOLLYWOOD (or Halifax) (5); though vv. 37-89 should have been included under Numeration, and the

(5) JOHANNIS DE SACRO-BOSCO *Tractatus De Arte Numerandi*, edited by J. O. HALLIWELL, *Rara Mathematica*, London, 1839, second edition 1841, pp. 1-26.

final sections on square and cubic root have been omitted. The agreement is not confined to the general plan, but frequently extends even to the wording; a number of extracts from the Latin text have therefore been included in the footnotes (preceded by SB. = SACRO-BOSCO), for the sake of the light which they throw on obscurities in the French. It is well known that the treatise by JOHN OF HOLYWOOD retained its vogue, and remained the basis of arithmetical teaching, down to the Renaissance (6). A comparison of the present poem with the thirteenth century algorism in French verse recently published (7) suggests retrogression rather than progress in the teaching of arithmetic; the fifteenth century work, though better preserved, is less lucid and its methods are even clumsier.

VERSIFICATION. Like most Old French didactic verse, the algorism is written in octosyllabic couplets. In a work of this nature, where artistic perfection was liable to be sacrificed to practical requirements, we may expect to find metrical irregularities. Yet there is no doubt that a great many of the inaccuracies presented by the manuscript are due to defective copying, not to the author. The large majority of the lines scan as normal octosyllables. A certain discretion must be exercised in choosing between elision and hiatus; thus in several instances we obtain a correct line by eliding the final vowel of a word spelt in full: *Che est* 19, 142, *de uns* 87, *Que une* 123, *qui après* 138, 400 (cf. 145), *ne un* 227, *Si avrais* (?) 428 (cf. 266), *li hons* 474; or by accepting a hiatus, e.g.: *de arismetique* 7, *nombre est* 91, *article est* 136, *que avrais* 162, *motie et* 254, *l'estude est* 478. In vv. 476 and 477 we may expand *c'on* as *que on*. The author allowed himself numerous options, especially as regards the counting or omission of feminine *e*, which in his day was becoming, or had become, obsolete in ordinary Walloon pronunciation (8). Pretonic *e* before a vowel is mute in *eust* 421 and *seussies* 472, and similarly in *meisme* 78, 283; yet in v. 26 *meïsme* (: *risme*) counts as three syllables. The imperfect indicative 2 sg. could end in *-oies* (*devoies* 185, *avoies* 266, 322, 428, cf. *avois* : *voies*? 328), *-oie* (*avoie* : *voie* 203), or *-ois*

(6) Cf. L. C. KARPINSKI, *Robert of Chester's Latin translation of the Algebra of Al-Khowarizmi*, New York, 1915, p. 16.

(7) In *Isis*, XI (1928), pp. 45 ff.

(8) Cf. COHEN, *Mystères et Moralités* (see below), pp. LV ff.

(*querois* : *drois* 296, cf. *avois* : *querois* 453). In certain futures an intercalated *e* was optional, e. g. : *prendrait* 28 but *prenderais* 190; *sarait* 32, *aurait* 73, but *saverais* 418. Sometimes it is clear that a supernumerary *e* is due to the scribe, or, if written by the author, had no metrical value for him : *brif(e)ment* 2, *quel(e)* 93, *met(e)rais* 161 (cf. *meterais* 388), *second(e)* 181, *teil(e)* 194, 274, *nonpeir(e)* 255, *aveq(ue)* 262, etc., *donk(e)* 324, *Quant(e)* 407. On the other hand the scribe appears to have omitted a syllable in the following instances, where the addition of feminine *e*, or *-es*, grammatically needed, restores the metre : *promier-e(s)* 82, 83, 250, 306, *tout-e* 115, *trestout-es* 167, *rajoust-e* 199, *quoy-e* 229, *droit-es* 267, *multipli-e-rai* 338, *Quant-es* 390, *cel-le* 396, *cel-es* 401. In *peire* : *nonpeire* 244, etc., *nonpeire* : *osteire* 252, *plaisiere* : *desire* 495, the posttonic *e* may have been added by the scribe. But in a score of instances the author himself appears to have ignored an etymological final or counterfinal *e*, not only after a vowel : *vrai(e)ment* 57, *moiti(e)* 246, *moiti(e)* 445 (cf. 254, 256, 456) (9), *multepli(e)* 342, but also after a consonant : *promier(e)-ment* 47, *quart(e)* 109, *figur(e)* 123, 166, *promier(e)* 106 (?), 124, 168, *tout(e) promier(e)* 236, *fair(e)* 249, 495, *tant(es)* 285, *second(e)* or *cel(le)* 284, *tant(es)* 285, *un(e)* 408, *Nul(le)* or *figur(e)* 413, *sciench(e)* (?) 486. That such pronunciations may safely be attributed to the author is finally proved by the rimes *dite* : *s'ensiète* 108, *seniète* : *nestè* 216 (cf. *nest* 179), and *compte* : *monte* (subs.) 433, in which etymological and inorganic *e* are combined; or by *just* (: *pust*) 115, where the *e* has been dropped. Similar rimes are plentiful in other Walloon poems of the period. There remain a number of definitely unmetrical lines, almost all of which could be regularized without difficulty. In v. 81 the *s* of *quatres* may be ignored. In vv. 109, 110, 111 and 204 it is possible that the ending *-tion* (dissyllabic in 107, 114, etc.) is monosyllabic; similarly *i* and *e* may perhaps be run together in *consciēche* 20 and *multipliyét* 269 (in spite of *sciēche* 19, *nient* 61, *multipliyër* 304, *consciēche* 494, etc.). Easy emendations, some of which have been adopted as indispensable to the sense, will add the missing syllable or syllables in vv. 89, 94, 95, 122, 165, 180, 190, 270, 311, 314 (-2), 346, 366, 402 (-2), 403, 423, 464 and

(9) On the dialectal form *moitfe* see 'Vowels' (8) below.

490. Vv. 67, 192 and 271 all very probably corrupt, are not so readily restored. In the absence of any means of control, no attempt has been made to introduce emendations on metrical grounds alone.

The rimes, which are mostly commonplace, are correct according to Liégeois pronunciation of the later Middle Ages. Allowance must be made, in particular, for the decadence of feminine *e* and final consonants. On no fewer than 37 occasions the author rimed a word with itself, without difference of meaning. Two successive couplets have the same rime in vv. 116-9, 134-7, 244-7, 312-5 and 326-9 (?). Vv. 62, 81 and 382 (or 380, if *faroit* be corrected to *farait*) stand by themselves unrimed; deficiencies in the sense indicate that the corresponding lines have dropped out. *Multiplie* : *article* 352 is a mere assonance, but there is no sign of a lacuna.

THE DIALECT. However little value this algorism may possess as a scientific document or as a literary performance, it well deserves publication as a dialectal text. Its language, as represented by the forms of the Ms. (borne out by the rimes, as a later paragraph will show), agrees closely with that of the Chronicle of JEAN DE STAVELOT (10) contained in the same volume; like the Chronicle, therefore, it represents the dialect used at Liège in the first half of the fifteenth century. Even without the guidance of the remainder of the volume, it would have been easy to identify the dialect of the algorism. Thanks to the work of a number of highly-qualified investigators, notably M. WILMOTTE (11), G. DOUTREPONT (12) and G. COHEN (13), the Walloon dialects of the later Middle Ages are now tolerably well known. Until a later date, it seems, than in any other province, writers of the Liège area continued to use their dialect, influenced but slightly by Central French, for literary and dramatic purposes. In compiling the following summary of the dialectal features of the algorism, I have utilized especially the publication of M. COHEN; the tho-

(10) Edited by A. BORGNET (see above).

(11) *Etudes de dialectologie wallonne*, in *Romania*, XVII, XVIII and XIX.

(12) *Etude linguistique sur JACQUES DE HEMRICOURT et son époque*, in *Mémoires couronnés ... publiés par l'Académie Royale ... de Belgique*, XLVI, 1892, n^o 5.

(13) *Mystères et Moralités du Manuscrit 617 de Chantilly (Bibl. du XV^e siècle)*, Paris, 1920.

roughness, the systematic arrangement and the recent date of his Introduction make it particularly convenient for reference.

VOWELS.

(1) The product of V. Lat. free tonic *a* is normally *ei*, e.g. : *nommeis* 6, *compteir* 12, *adjosteit* 154, *teile* 194, *peire* 243, *uniteit* 258, *remeise* 419, *seit* (*sapit*) 481; except when preceded by yod (e.g. *sachies* 101, *multiplyét* 269, *avanchier* 302) or followed by fem. *e* (e.g. *ostee* 232, *menee* 278). Other exceptions are *adjosté* 153, *unité* 180, and perhaps *regardé* (for *-deir*) 313.

(2) *an* and *en* are kept distinct, the only exception being *manrais* 282 (but *menrais* 286).

(3) *ai* is occasionally reduced to *a* : *afature* 38, *fat* 69, *lasseras* (?) 169; and French tonic *a* is sometimes represented by *ai* : *pais* 164, 233, *ais* 426 (14). In futures, 2 and 3 sg., *ai* is usual, e.g. *prendrait* 28, *vorait* 30, *deferais* 142, *aurais* 162; but exceptions are fairly frequent, e.g. : *sera* 77, *avras* 89, *venra* 259.

(4) *au* is occasionally reduced to *a* : *faroit* 381, *acunne* 419; but *autre* 16, *altre* 123, *aultres* 126, *vaut* 180, etc. Conversely *au* is written for *a* in *debautre* 15; cf. *abautre* in Stavelot's Chronicle, p. 367, l. 26, *daute* *ibid.*, p. 127, l. 11, etc.

(5) Blocked tonic open *e* appears to be diphthongized in *diestre* 128, 232, 397, *seniestre* 206, 276, 378, *tieste* 485, *molieste* 486; but *appelle* 10, *après* 27, *estre* 277, etc. There is one instance of *ei* : *seneistre* 233; cf. *deis* 85. We find *ie* and *ei* for *e* occasionally in pretonic position also : *viereis* 35, *dieraines* 48; *teis* (*tuas*) 409.

(6) Initial *as-* for *es-* : *astoit* 212, 332; but elsewhere *estoit*, *estuet*, etc.

(7) Closed *e* + *l* + consonant produce *eau*, not *eu* : *eaux* (*illos*) 130, 323, etc.

(8) *ie*, being a descending diphthong, not ascending as in Central French, is sometimes reduced when internal to *i* : *brifement* 2, *manire* 194, perhaps also *vint* (for *vient*?) 68. Conversely *ie* is written for *i* : *chemien* 297, *plaisiere* 495. When final, *ie* becomes *ïe* : *moïïe* 256, *motïe* 254, 456, and the feminine *e* could be ignored in the counting of syllables (15).

(14) According to E. G. WAHLGREN, in *Mélanges Vising*, Göteborg and Paris, 1925, pp. 290 ff., this *ai* represents open *e*.

(15) See 'Versification' above.

(9) *ein* has become *ain* : *amaine* 126, *maine* 329, *plain* 479, *plaine* 485; it has not become *oin* in *mains* 186, 187, 341, 376 (but *moins* 84).

(10) Pretonic *e* is always rounded in the word *promier* 44, etc., cf. *promierement* 47, *promerain* 333, 393. The scribe sometimes wrote the *pro-* in full, more often used a contraction.

(11) The capricious treatment of feminine *e*, which is added or omitted at random, and of vowels in hiatus, is discussed in the sections on Versification and Rimes.

(12) The product of V. Lat. free tonic open *o* is written *ue* : *puet* 98, etc., *estuet* 99, etc.; but the spellings *vuet* 319, *vues* 455 suggest *æ* as the pronunciation. A preceding *v* absorbs the *u* in *aveque* 328, etc.; the spelling *avoit* 358 may be a mere corruption. *Lieu* (*locum*) 67, etc., is the standard French form.

(13) Tonic *oi* is reduced to *eu* (presumably *æ*) in *valeur* 213 (the normal modern Liégeois infinitive); but *savoir* 24, *valoir* 67, etc. Pretonic *oi* is reduced to *o* in *motie* 244, 254, 445, 456, 457, but remains intact in *moitie* 231, 246, 256, 451, 463, and other words. On the other hand tonic *o* is represented by *oi* in *toist* 33, 356, *tantoist* 369, 458, 472, *hoir* 159, *conpoist* 357, and similarly pretonic *o* in *repoiseit* 163; but *tantost* 21, *dehors* 95, *compost* 342, etc. (16). In the numeral *oit* (the Walloon form from *octo*) the diphthong has become two separate vowels with a labial glide : *ouwetemme* 113 (cf. *ou viii* 104?).

(14) Free tonic closed *o* gives *eu* : *deseur(e)* 169, 178, etc., *meneur* 316, *songneux* 473, *convoiteux* 474; but *menour* 425. The numeral *dois* (*duos*) 52, etc., is probably influenced by *trois*.

(15) *ui* is reduced to *u* in *pust* 114, but not elsewhere. It undergoes metathesis in *pius* 182, 287, 323, 356, 364, 401, 427, the *i* being picked out by an accent in nearly every instance; but *vuis* (**vocitus*) 299, also with the *i* accented.

(16) *on* is substituted for *un* in *commonement* 46, *casconne* 54, 63, *alcons* 59, *on* 231. There is no reliable instance of *un* for *on*; *summe* 47 may be a Latinism.

Miscellaneous. The conjunction *mains* 50, 59, 95, et passim, still the normal Liégeois form, is probably due to contamination of *mais* and *ains*, not to progressive nasalization (17); *magis* used

(16) The phonetic significance of this *oi* is discussed by WAHLGREN, *op. cit.* pp. 311 ff. •

(17) Cf. COHEN, p. LIV.

adverbially gives *mais* 467 or *mes* (?) 399. Note *pou* (*paucum*) 9, 368, *reclout* (*reclaudit*) 20, *chouse* (*causa*) 419, and *ie* for *ieu* in *ensiete* (**insequit*) 109. There is only one doubtful instance of the omission of prosthetic *e* before *s* + consonant : *studioier* 473 (cf. *est-* 492).

CONSONANTS.

(1) Vocalized *l* falls not only after *i* (*subtis* 5) as in Central French, but also after *a* and *e*, e.g. in the contractions *al* and *del* (see Declension). The suffix *-ellus* is represented by *joweais* (**jocellos*) 480; cf. the forms *beais* (*bellos*), *cheais* (*ecce-illos*), etc., presented by other texts in the same Ms.

(2) *l*-mouillé is normally represented by *lh*, a characteristic Walloon spelling : *subtilh* Prol., *ilh* 31, *milhier* 71, etc.; cf. Cohen, p. xiv, 16.

(3) Final unsupported *t* is commonly preserved after an accented vowel, e.g. : *at* 21, *subtiliteit* 22, *prendrait* 28 (and other futures), *fut* 45, *multiplyét* 460, *entendut* 469, *vuidiet* 487; but exceptions are fairly numerous, e.g. : *trova* 44, *a* 104, *appellera* 105, *adjosté* 153, *unité* 180. In *appellet* 62 the preservation of the *t* after posttonic *e* is due to the inverted combination with *on*; cf. *appelle* 10, *fache* 187, *multiplye* 307, etc.

(4) Between *n* and *r*, *l* and *r* there is no glide *d* : *convenrait* 29, 424, *-ra* 78, 305, *vorait* 30, *vora* 304, 368, *venrait* 130, *-ra* 344, *revenrais* 191, *remanra* 258, *faroit* 381, *menre(s)* 383, 420.

(5) *c* before *a* remains unchanged in *casconne*, *-unne* 54, 63, 353, 380; but we find *ch* in *conchiet* 488.

(6) V. Lat. *c* before *e*, *i*, and *t*, *c* + yod are represented either by *ch* : *ch'* 3, *scienche* 8, *cheli* 12, *ychi* 64, *recommenchie* 79, *tierche* 108, *fache* 187, etc.; or by *c* : *ceu* 2, *certainement* 3, *celle* 9, *cent* 69, etc.; and in one instance by *s* : *espises* 104. The Arabic word *cyfre* normally has *c*; but *chiffre* 38.

(7) The final *c* which is usually added to *un* (indefinite article and numeral), doubtless indicating nasalization of the vowel, is frequent in Liégeois texts.

(8) A glide *w* has developed in *Juwis* Prol. (but *Juys* 43, 45), *ouwetemme* 113, and *joweais* 480.

(9) Mute consonants. The decadence of final *s* and *t*, though not strictly a dialectal trait in the fifteenth century, is a striking feature in this and contemporary Liégeois texts, producing as

it does utter confusion in the endings of words. Thus not only is *s* dropped (*thier* 69, *vou* 467) and *t* dropped (*comp* 46, *tou* 50, *secon* 68, *compos* 92, 98, etc., *gran* 101), but *t* is substituted for *s* (*fait* 2 sg. 341) and *s* for *t* (*fais* 3 sg. 52, *dois* 3 sg. 214). In *escript* 141 an inorganic *t*, as well as etymological *p*, has been added to the imperative 2 sg. The fall of *s* before another consonant is illustrated by *puit* 270, *toudis* 495. The spelling *traitier* 28 for *-tié* suggests that final *r* was mute, at least in this suffix.

DECLENSION.

(1) Relics of the two-case system. The declension system seems to have been preserved down to a relatively late date in north-eastern France; but flexional *s* was bound to lose its value in Middle French, owing to the decadence of final consonants. In the algorism there is great confusion of case-forms; but some recollection of the two-case system certainly persisted at Liège at the time when it was written down. Whole phrases sometimes appear in their Old French form, or very nearly so, e.g. : *Quant tes nombre serait fais tos* 295, *ses lieu vuis est* 299, *li plus grans dois* 314, *tes tes nombres* 340, *si fais menres est* 420. Adjectives and participles used predicatively are sometimes given *s* : *subtis* 5, *renommeis* 5, *nommeis* 6, *osteis* 159, *grans* 421. Nominative *s* appears to be added for metrical reasons to *articles* 92, 96, 139 (cf. 136, 217), and for the sake of rime to *mos* 93, *biens* 101, and *drois* 297; cf. *fois* 53. *Juwis* Prol., *Juys* 43, 45, has nom. *s* in each instance. *Ons* (*homo*), used as indefinite pronoun, usually has analogical *s*, cf. *li hors* 474; but *on* 34, 62, 96, 98, 101. In many instances, however, the choice of form appears to be purely haphazard, e.g. : *tous nombre* 91, *les promier dois* 129, *dois nombre parfaits* 161, *de trestos clain* 480; *le dois* 321 but *le doit* 322; *tes nombres* 345 but *ton nombre* (nom.) 350; fem. *additions* 118 (cf. *li fins* 444) but *subtraction* 156, *grant* 171 but *grans* 172. *Meneur* 316, 377, *-our* 425, occurs in accusative use only, *menre(s)* as predicate 383, 420, and as accusative 317. Other relics of the two-case system will be found in the pronouns and definite article.

(2) Analogical feminines. Only *grant* 47, 171, 450, and *grans* 172, 174, 176, occur as feminine forms, not *grande*. The addition of *e* to *teile* fem. 274, 392, *peire* and *nonpeire* passim, has no significance; cf. *quele* masc. pl. 93.

(3) Definite article. Masc. sg. nom. *li* 43, *ly* 7; acc. *le* 30, *l'* 10, *li* 446 (the only instance); pl. nom. *les* 120; acc. *les* 11, *le* 329. Fem. sg. nom. *la* 82, *le* 124, *li* 112, 231, 411, 444, *ly* 51, 106, 113, 258; acc. *la* 38, *l'* 38, *le* 13, 168, 244, etc.; pl. nom. *les* 48; acc. *les* 81, *le* 83.

(4) Preposition + definite article. With *a* : masc. sg. *al* 87, 137, 186, *a* 333; fem. sg. *a la* 453, 486. With *de* : masc. sg. *del* 157, 347, *de* 374, 420; + vowel, *del* 221, 317, 321, 327, *de l'* 10, 149, 358, 360, 361; pl. *des* 260, etc., *de* 16, 146, 177; fem. sg. *de la* 179, 451, *del* 8 (cf. *del summe* in Stavelot's Chronicle, p. 361, l. 21), *de* 246, 256, 450; pl. *des* 430, 456, 461, *de* 14. With *en* : masc. sg. *ou* 259; + vowel, *en l'* 489; fem. sg. *en-la* 27, 138, 293.

(5) Personal pronouns. Sg. 1 *je* 496; dat. *me* 121; 2 *tu* 134, etc., *t'* 199, 203, 209; acc. *t'* 251; dat. *t'* 405, accented form *toy* 429; 3 masc. *ilh* 31, 421, 449, 485, 488; acc. *le* 482 (?); dat. *li* 484; fem. *elle* 59, 68, 85, 300 (?), *ilh* 65, 72, 176, 244, 245, 253; acc. *le* 20, 29, 31, etc., *l'* 21, etc. (*len* 40 is doubtless corrupt), accented form (after prep.) *li* 22, 299, 465, *ly* 58, 141, 228; dat. *li* 279; neut. *ilh* 37, 87, 100, etc., *il* 140; acc. *le* 432, 496. Pl. 1 acc. *nos* 494; dat. *nos* 493; 2 *vos* 35; acc. *vou* 467; dat. *vos* 53; 3 masc. *il* 122, *ilh* 132; acc., accented form, *eaux* 130, 323, etc.; fem. acc. *les* 417, *le* 289, 406.

(6) Possessives. Note *tes* masc. nom. sg. 295, 340, 345 (but *ton* 350); *ton ovrangne* (fem.) 430; *se* fem. sg. 189 (but *sa* 20, 28); *no* fem. sg. 381.

(7) Demonstratives. Pronominal : masc. sg. nom. *chis* 44, 98, *chil* 165, *cheli* 162; acc. *cheli* 426; fem. sg. nom. *celle* 9, etc., *cel* 394, 396, *chil* 172; acc. *celle* 182, etc., *cel* 190, 287, 391, *chel* 393, *cheli* 78, 133, 169, etc.; pl. acc. *celes* 402, *cel* (?) 401; neut. sg. *che* 19, etc., *ch'* 3, 441, *chu* 399, 428, 448, 454, 466. Adjectival : masc. sg. nom. *cel* 28; acc. *ceu* 2, *che* 134; pl. acc. *ches* 102, 372; fem. sg. acc. *cheli* 25; pl. acc. *ches* 117, 415.

(8) Relative pronoun. Nom. sg. *qui* undergoes elision in 145, 179, 212, 332 (?).

(9) Numerals. *Dois* 'two' is invariable, probably on analogy of *trois*. Similarly *andois* 344. Note the ordinal ending *-emme* : *disemme* 57, *septemme* 112, *ouwetemme* 113.

CONJUGATION.

(1) On the future endings *-ais* (2 sg.) and *-ait* (3 sg.) see 'Vowels' (3).

(2) The 2 pl. ending for the indicative present, imperative and future is always *-eis* : *viereis* 35, *porseuereis* 36, *veis* 40, *deveis* 90, *meteis* 273, *aveis* 469, 470.

(3) The imperative 2 sg. *ramenche* 409, from *ramener*, is doubtless an analogical form, possibly based on *commenche*.

(4) Intercalated *e* is found in the futures *porseuereis* 36, *prenderais* 190, 418, *meterais* 388 and *saverais* 418. The conditional *esseroit* (Ms. *efferoit*) 243 is too uncertain to be taken into account.

(5) The future of *avoir* and *savoir* hesitates between the forms with and without *v*, e.g. : *avrait* 73, *avras* 89, but *sarait* 32, *aras* 155, *sara* 369, etc. The *v* may be regarded as consonantal (Ms. always *u*), in view of *saverais* 418; but for the scribe it was probably mute, hence the spelling *yuras* (for *iras*) 251.

(6) On futures without a glide *d* see 'Consonants' (4).

(7) Imperfect subjunctive *fuissent* 431, but *eust* 421, *seussies* 472.

Miscellaneous. The usual analogical terminations are becoming normal in the 1 and 2 sg., viz. 1 sg. in *-e* : *cuide* 490, *desire* 496; 1 sg. in *-s* : *dis* 23, 40, 53, 93, 387 (but *di* 64); imperat. 2 sg. in *-s* : *refais* 150, 175, *fais* 151, etc., *defais* 174, *mes* 186, etc., *prens* 180, etc., *vas* 223, 263, 323, *fiers* 241, *pars* 463 (but *met* 166, 167, [*de*] *fay* 192, *refay* 193, cf. *refait* 291, *fait* 341). In the imperfect indicative 2 sg. *-oies* and *-ois* are used concurrently; see 'Versification'. Analogical *-e* in the present subjunctive is represented by *donne* 493 and perhaps *voise* 482; but a number of old forms are preserved : *puist* 114, 373, 395, 471, *puit* 270, *comment* (for *-nst*) 206, *demeurt* 489. In these developments there is nothing distinctively Walloon.

THE RIMES. It is clear that the algorism, as it stands in the Ms., is written in the Liégeois forms that Jean de Stavelot himself used. But we can hardly believe that it was his own composition. Would he have permitted his own work to be disfigured, as this is, by corruptions and omissions, only the more flagrant of which are corrected or pointed out in the present edition? Would he have omitted the example which is clearly required after v. 77? STAVELOT was not incapable of perpetrating verse,

witness the rimed insertions in his Chronicle (18); but in this instance we must assume that he was transcribing the work of some other author (19). The linguistic evidence indicates, however, that the original author was not far removed from JEAN DE STAVELOT in either place or time. A study of the versification has proved that the scribe, in his capricious treatment of feminine *e* and vowels in hiatus, was merely exaggerating tendencies already shown by the author. A study of the rimes leads to a similar conclusion. Although they are of a hackneyed and obvious nature, often identical or consisting of words from the same root, with many repetitions, they nevertheless suffice to show that the author's dialect agreed completely with that of the scribe. Thus *en* and *an* are kept distinct; *au* before a consonant is reduced to *a* (*debautre* : *autre* 15, for *debatre* : *atre*); the diphthong *ie* becomes *ïe* (*moitie* : *multiplie* 451, 457, *moities* : *parties* 463) or is reduced to *i* (*s'ensiète* (20) : *dite* 109, *promière* : *dire* 124); *ein* becomes *ain* (*amaine* : *deraine* 126, *plain* : *clain* 479); *oi* and *o* are confused (*remanoir* : *hoir*, for *hors*, 159 (21)); *ui* is reduced to *u* (*pust* : *just* 114, *cuide* : *estude* 476, 490); and *on* and *un* are confused (*deson* : *un* 284). Unsupported and supported *t* are rimed together (*estudiet* : *siet* 483). *Dois* 'two' rimes with *dois*, from *debes*, 132, 146. On some points the rimes are inconclusive; thus *ei* from free tonic *a* rimes only by itself (e.g. *nonpeire* : *osteire* 252) and with the 2 pl. ending *-eis* (*uniteis* : *meteis* 272); similarly the futures in *-as*, *-a* or *-ais*, *-ait*, and the pronoun *eaux* (*illos*) rime only by themselves. *Estoit* (: *doit*) 278 and *astoit* (: *doit*) 332 may represent *estait*, ind. pr. 3 sg. of *ester*, thus giving rimes of *ai* with *oi*; but they may equally well be the imperfect of *estre*, the imperfect being often used irregularly in this text. The diphthongization of blocked open *e* is not borne out by the rimes, cf. *diestre* : *mestre* 397 (*diestre* : *seneistre* 232, *seniestre* : *estre* 276, 378, and *tieste* : *molieste* 485 are inconclusive); but Walloon poems show great hesitation in the treat-

(18) ed. BORGNET, pp. 368 and 384.

(19) GACHET, *op. cit.*, p. 186, left the question of authorship open : 'Nous serions fort embarrassé pour dire la part qui revient à JEAN DE STAVELOT dans ce traité compilé par lui.'

(20) *Ensiere* (**insequere*) is a Walloon form; cf. M. WILMOTTE, in *Etudes romanes dédiées à Gaston Paris*, Paris, 1891, p. 241.

(21) Cf. *espoir* : *confoir* (= *confort*) in STAVELOT's *Chronicle*, p. 368; *lhoirs* (= *lors*) : *fors* (= *forts*), *ibid.*, p. 373.

ment of this vowel (22). The dialectal developments listed under 'Consonants', though not as a rule confirmed by the rimes, are in no instance contradicted. The peculiar imperative *ramenche* 409 rimes with *commenche*. That the algorism was not composed until late in the Middle Ages is indicated by the breakdown of declension, the analogical developments in conjugation (*cuide* : *estude* 476, 490; *dis* : *dis* 'ten' 40, but *di* : *autresi* 64; *querois* : *drois* 296, but *avoies* : *voies* 266), the haphazard treatment of feminine *e*, and the extraordinary confusion prevailing among final consonants. To the illustrations of this last feature already mentioned under 'Consonants' may here be added others guaranteed by rimes. Final *s* is ignored in rime (*ensengnement* pl. : *aprent* 11, *figure* pl. : *afature* 37, *desu* : *tu* 391, *qui* : *li* 466), or arbitrarily added (*fois* sg. : *trois* 53), or replaced by *t*, both consonants being mute. *Doit* (: *estoit*) 279, *refait* (: *fait* subs.) 291, *fait* (: *fait* 3 sg.) 341 and *porat* (: *at*) 440 must all be interpreted as 2 sg. forms; whereas *ferais* (: *avrais*) 325 is a 3 sg. form, with the converse substitution of *s* for *t*. Whether *compos* : *mos* 92 and *est* : *mes* 220, 288, 299, were intended to be rimes in *s* or *t* is difficult to determine. There is less evidence to prove that final *r* was mute; but *avoir* (: *valoir*) 271, if not corrupt, may be interpreted as an imperfect indicative 3 sg. That *s* before a consonant had fallen from pronunciation is shown by the riming of *risme* (O. Fr. rime) with *meisme* 25, and by *comment* for *-nst* (: *seulement*) 206. In *senieste* (: *neste*) 26 for *-estre*, the *r* becoming final has fallen as well as the posttonic vowel (23). We may therefore conclude that in all probability the author of the poem belonged to the same place and period as the scribe, viz. Liège in the first half of the fifteenth century.

SYNTAX. Attention may be called summarily to a few interesting features.

(1) *Qui* used indefinitely introduces a conditional clause : vv. 2, 30, 102, 304.

(2) *Com* (*quomodo*) is virtually equivalent to a relative pronoun in vv. 155 and 328; but not in v. 218, though the circumstances seem similar.

(3) Reflexive verb with passive sense : vv. 156, 214-5, 255-6.

(22) Cf. COHEN, p. XXXIII.

(23) Cf. COHEN's examples, pp. LVI f.

(4) *Se* 'if' followed by present subjunctive : vv. 146-7, 218-9.

(5) Compound tense of a verb of motion formed with *avoir* : vv. 202, 267, 297.

(6) *Voloir* + infinitive as circumlocution for the future : vv. 31 (?), 319.

(7) *Devoir* with ellipsis of a following infinitive (*estre?*) : vv. 122, 396.

(8) *Pooir* with ellipsis of a following infinitive (*faire?*) : v. 376.

(9) Parataxis : vv. 491-3.

THE TEXT. The Ms. has been accurately reproduced, with occasional corrections suggested, or rather demanded, by the sense. A few words and letters added to the text have been enclosed in square brackets. All other departures from the Ms., even in the division of words, are indicated in the footnotes. The usual liberty has been taken in modernizing *i* and *j*, *u* and *v*, and in accenting *e* when there is a possibility of confusion with the unaccented vowel. The letters *b* and *v*, as written by JEAN DE STAVELOT, are sometimes difficult to distinguish. The expansion of contractions offers no difficulty. The sign ⁹ has been resolved as *com* before a labial consonant (*compte* 16, *commonement* 46, *compos* 132, etc.), in spite of several examples of *con* written in full (*conpos* 309, 311, *conpost* 352, *conpoist* 357); similarly the nasal bar has been resolved as *m* in *nombre* 1, *com* 35, *disemme* 57, *ensemble* 119, etc. (cf. *nombre* 7, *compteir* 12, *ensemble* 39, etc., written in full). All expanded letters are italicized.

Miss M. K. POPE, who possesses exceptional experience in the treatment of Old French dialectal texts, has kindly read both the text and the introduction in manuscript, and made a number of helpful suggestions. I take this opportunity of thanking her warmly.

Chi après s'ensyet la noble et subtilh scienche qui est appelleit le compte de algorisme, *partant* que chis qui le fist avoit nom Algorisme, qui estoit uns Juwis.

- Algorisme si est .i. nombre. fo. 210b
 Qui brifement *conte et met* ceu nombre,
 Ch'est .i. *compte certainement*
 Qui en nul fait *certain ne ment*,
 5 Qui mult subtis est *renommeis*,
 Et si est aultrement *nommeis*
 Ly nombre de arismetique.
 Del scienche mathematique
 Desquent, et celle qui pou vaque,
 10 Que ons appelle de l'abaque
 Les tres nobles *ensegnement*.
 Et cheli a compter aprent
 Et a *nombreir par* le jointure
 De .ix. et le cyfre figure,
 15 Et multiplyer sens debautre
 L'un de *compte* tot *parmi* l'autre,
 Et departir, et deviseir,
 Et l'un de l'autre *enssi* sevreir.
 Che est une *mult* noble scienche.
 20 Qui le reclout en sa *conscienche*
 Si l'at tantoist en haste apris,
 S'en li subtiliteit a pris.
 Si vos dis et fay assavoir,
 Qui algorisme vuet savoir,
 25 Si entende bien cheli risme
 Parfaitement, et le meisme
 En après jusques en la fin,
 Ou cel traitier prendrait sa fin;
 Car tout le *convenrait* savoir,
 30 Qui le profit vorait avoir.
 Et s'ilh le vuet bien retenir,
 Bien sarait dire sens mentir
 Mult de *comptes*, et toist leveir
 Come riens c'*on* poroit *penseir*,
 35 Si *com* chi après vos viereis,
 Et vos bien le porseuereis.
 Ilh n'y at plus *que* .ix. figure
 Et la chiffre por l'afature,
 ' Qui font trestout ensemble .x.

Here follows the noble and subtle science which is called the calculation of algorism, for the reason that he who invented it was named Algorism (he was a Jew).

Algorism is a system of numbering. If one employs that system when reckoning rapidly, without doubt it is a form of reckoning which tells no lie on any exact point; it has a high reputation for accuracy, and is otherwise known as the system of arithmetic. It forms part (?) of mathematical science, as also does that branch which is seldom idle (?), called the very noble teachings of the abacus. The present branch teaches how to reckon and to calculate by means of the combination of the nine figures and the cypher, to multiply one set of figures by another without contestation, to split up, and to divide, thus separating one from the other. It is a very noble science. He who encloses it in his mind has forthwith speedily learnt it, if he has acquired accuracy in the use of it. I tell you and inform you, then, that he who wishes to know algorism should listen carefully to this poem, and continue to do so until the end, where this treatise will terminate; for he who wishes to profit by it must know the whole of it. And if he will remember it well, he will be able to carry out many reckonings without a mistake, and to effect (?) them with the greatest imaginable speed, as you shall hereafter see, provided you do not relax your attention.

The apparatus consists merely of nine figures and the cypher,

1. *Large capital G in error for A.* 9. *Desquent et corrupt?* or *a lacuna?* 10. *Ms. la baque.* 25. *Ms. tisme.*

- 40 Veis le chi, enssi que je dis :
 o 9 8 7 6 5 4 3 2 1.
 A reculons le doit ons lire,
 Enssi *com* li Juys escrire;
 Car chis qui *promier* le trova
- 45 Juys fut *quant* l'*aconstuma*.
 Enssi comp[te] ons *commonement*
 La plus grant *summe* *promierement*.
 Enssi les figures dieraines
 Font *mult* plus *que* les *devantraines*.
- 50 Mains de che soies tou *certain* :
 Ly *promier* a la bonne main
 Fais .i., l'autre dois, l'autre trois; fo. 210c
 Et je vos dis en bonne fois
 Que casconne figure fait
- 55 Tant qu'a son nombre at son tour fait
 Jusques a .ix. tant seulement.
 La cyfre est *disemme* vraiment,
 Qui par ly seule ne valt *riens*,
 Mains elle valt en alcons biens,
- 60 Ou tient le lieu tout seulement;
 S'at nom figure de nient,
 Ou cyfre, ensi l'appelle-t-on...
 Casconne figure autresi
 Fait tant *com* ychi je vos di;
- 65 Car *quant* ilh est a *promier* mise...
 Si fait .x. tant, et s'a devise
 Que valoir en *promier* lieu
Quant elle vint en secon lieu;
 Et en thier lieu fat tant de cent
- 70 Qu'*en* *promier* lieu valt *proprement*;
 Et en quart lieu tant de milhier
 Con ilh valoit tout a *promier*.
Quant plus de .x. ons y avrait,
 Si vos diray que ons ferait :
- 75 Ons *comptera* jusques a quatre;
 Adonc *covient* que trois de quatre
 Faire, et escrit ensi sera :...
 A cheli *meisme* *convenra*

making ten in all. Here it is, just as I say : 0 9 8 7 6 5 4 3 2 1. It must be read backwards, and written just like a Jew writes; for he who first invented it was a Jew when he brought it into use. Thus the largest number is commonly counted first [*i.e.* when read in the ordinary way]. Thus the last figures are of much higher value than the first. But be quite sure of this : the first figure on the right represents one, the next two, the next three; and I tell you in good faith that each figure represents its respective number up to nine and no farther. The cypher indeed comes tenth; by itself it is worth nothing, but it is useful for certain purposes, or merely occupies the position. It is named the figure nought, and is also known as cypher... Each figure likewise represents the amount that I here tell you; for when it is placed first, and in the third position it represents a hundred times as much as it is actually worth in the first position; and in the fourth position a thousand times as much as it was worth at the beginning. When more than ten (?) [figures] occur in a number, I will tell you what must be done : one must count [the figures] up to four, then make three from four [*i.e.* separate the first

40. le] *Ms.* len. 45. *Ms.* la constuma. 46. or comp[tions] ? 64. voy corrected to vos. 65-8. *Passage corrupt.* 73. x] *corr.* iii ? 76. covient que] *corr.* covenra ? 77. *Ms.* escrire.

- Recommenchier a racompteir,
 80 Et jusques a quatre compteir,
 Et por les quatres adés trois faire;
 Et la promier qui serait
 Sor le promier trois ferait
 Ne plus ne moins tant de milhier
 85 Com elle fait deis a promier;
 Celle après fait tant de .x. mil
 Com ilh at de .i. al promier mil.
 Ensi toute les prisceras,
 Tant com adés en avras.
 90 Après si deveis vos savoir
 Que tous nombre est dois par voir,
 Ou articles est, ou compos;
 Et quele sont vos dis a brief mos :
 Dois [est] tos nombres jusqu'a dis,
 95 Mains que .x. soit dehors mis.
 Articles est c'on puet partir
 En .x. pars sens riens retenir.
 Nombres compos est chis c'on puet
 Deviseir en .x., et s'estuet
 100 Qu'ilh ait aveque aucune riens.
 Et sachies c'on en at gran biens,
 Qui ches nombre connoistre puet,
 Et tresbien savoir les estuet.
 Ly nombre .viii. espises a,
 105 Que ons ensi appellera :
 Ly promier numeration, fo. 210d
 Et la seconde addition,
 Subtraction la tierche est dite,
 La quarte duplication s'ensiete,
 110 La quinte dimidiation,
 La sexte est multiplication,
 Division est li septemme,
 Progression est ly ouwetemme.
 [I] Numeration est c'on pust
 115 Tout riens compteir, et bien just,
 Tout che que ons poroit penseir,
 Et par ches figures nombrecir.

three], and write the number thus : . . . ; at that same figure [*i.e.* the fourth] one must begin counting again, count up to four, and forthwith make three for the four; and the first figure which follows the first three will represent a thousand times as much, neither more nor less, as it represents at the beginning; the following figure represents ten times as many thousands as there are units in the first thousand. Thus you must value them all, so long as you have any left.

Next you should know that every number is a digit indeed, or it is an article, or a composite number; and I will tell you briefly what these are : A digit is every number up to ten, provided ten be excluded. An article is a number which one can divide into ten parts, without having anything left over. A composite number is that which one can divide into ten, and something more must accompany it. And know that if one can distinguish these numbers, one derives great advantage therefrom; and they must be known thoroughly.

The science of numbers includes eight operations, which must be named as follows : the first numeration, the second addition, the third is called subtraction, the fourth duplication comes next, the fifth dimidiation, the sixth is multiplication, division is the seventh, progression is the eighth.

I. Numeration is that one may be able to count and number by means of these figures, with great precision, everything imaginable.

Line missing after 81?

104. *Ms.* ou .viii. = ouwet (*cf.* 113) ? 110. *Ms.* diuidiation.

I]

- Additions fait adjousteir
 Et *compteir* ensemble, nombreir
 120 Combien les dois valent ensemble;
 Et après covient, che me semble,
 Qu'il [soient] .i. nombre. Et enssi doit
 Que une figure sor altre soit,
 Le *promier* sour l'autre *promiere*;
 125 Après, c'on doit seconde dire;
 Et les aultres ensi amaine
 Jusqu'a la .ix.^e et deraine.
 Et a diestre *commenchier* dois,
 Et adjousteir les *promier* dois,
 130 Et li nombre qui d'eaux venrait
 Ou dois ou article ferait,
 Ou *compos*. Ou s'ilh ne sont dois,
 Cheli desous defaire dois,
 Et en che lieu dois tu refaire
 135 Unc, qui les dois devant apaire.
 [S']article est, si dois tu faire
 Unc al *promier*, ou altre faire
 En la figure qui après est;
 Li doit donc ly articles est.
 140 Et s'il avient que cyfre soit,
 En lieu de ly escript le doit;
 Se che est .ix., si le deferais,
 Et en son lieu cyfre ferais;
 Le droit *compte* faire *convient*
 145 En la figure qu'après vient.
 Et se li nombre de dois dois
 Soit *compos*, *promier* faire dois
 Le dois qui est oultre l'article;
 Et le dois qui est de l'article...
 150 Et la figure après refais,
 Ans les dois dois en *après* fais.
 Tous les aultres adjosteras
Com les *promiers* adjosté as.
 Quant ensi avras adjosteit,
 155 S'aras che *com* as demandeit.
 Subtraction se fait osteir

[III]

II. Addition enables one to add and count together, to reckon how much two numbers are worth when put together; and afterwards it is necessary, so it seems to me, that they should form one number. It is essential that one figure should be placed over another, the first of one number over the first of the other; next one should put the second; and bring the others thus in their order down to the ninth and last (?). You should begin on the right and add together the first digits, and the number produced by them will make either a digit or an article or a composite. If the number does not consist of two figures [*i.e.* if it is less than ten], you should cancel the under figure, and in its place set a single figure which combines the two previous ones. If it is an article, you must write a one first, or alter the following figure; the digit is then the article. And if it [*i.e.* the next figure] happens to be a cypher, write down the digit in its place; if it is a nine, you must cancel it, write a cypher in its place, and make the correct adjustment in the figure which comes next. And if the sum of the two digits is a composite, you should first write down the digit which follows the article; and the digit which forms the article itself.....; alter the following figure, and then write down both the digits. You must add all the others in the same way as you have added the first ones. When you have added up in this manner, you will have what you wanted.

III. Subtraction enables one to deduct a second number from

118. *Additio in right margin.* 120. *Ms. Com bien (et passim).* 132. *Ou s'ilh] corr. Et s'ilh or Or s'ilh ?* 133. *Ms. de faire.* 141. *Ms. En luy ne ly; cf. SB., p. 6, l. 17 : loco illius deletæ scribatur digitus articuli.* 144. *Ms. compte est faire.* 156. *Substratio in right margin.*

- Del nombre .i. altre, et plus *compteir*
 Combien ilh poroit remanoir
 Quant li nombre osteis serait hoir.
- 160 Et a diestre *commencherai* : fo. 211a
 Dois nombre parfaits y meterais,
 Et cheli que avrais osteit
 Soit trestos desous reposit;
 Et si ne doit pais si *grans* estre
- 165 *Com* chil de deseur puet estre.
 Une figure sor altre met,
 Et ensi trestout les met.
 Le *promier* desous osteras
 De cheli deseur. Lasserai...
- 170 La figure qui desous est
 Ou plus grant ou plus petite est,
 Ou enssi *grans com* chil estoit
 Qui *pardesur* escript estoit.
 Se si *grans* est, si le defais,
- 175 Et en son lieu cyfre refais.
 S'ilh est plus *grans*, osteir en dois...
 Une figure de dois dois.
 Se celle deseure menre est,
 De la figure qu'après nest
- 180 Prens [une] unité, qui vaut .x.,
 Por che qu'en seconde lieu l'as pris;
 Celle desous plus osterai,
 Et le ramanant referai.
 Et s'ilh *avient* que ilh ait .i.
- 185 Dont si devoies prendre l'un,
 Si l'oste, et cyfre y mes al mains,
 Que celle après ne fache mains.
 Et s'ilh *avient* que cyfre soit
 La ou se jointe prendre doit,
- 190 Et cel après prendrai;
 Et quant ariere revenrai,
 Chascunne cyfre defay,
 Et après .ix. devant refay.
 La seconde oste en teile maniere
- 195 *Com* tu as osteit la premiere.

the first, and then to reckon how much may be left when the number is taken away. You must begin on the right : you must write down there two entire numbers, and the number which you are going to take away must be set underneath in its entirety; it should not be so large as the number above. Put one figure over another, put them all thus. You must take away the first under number from the one above. You must leave The figure which is beneath is either greater or less than, or equal to, that figure which was written above it. If it is equal, cancel it, and write a cypher in its place. If it [*i.e.* the upper figure] is greater, you should take from it..... one figure from the two digits. If the figure above is less, take from the figure which comes after it a unit, which is worth ten because you have found it in the second position; then you must take away the figure below, and write down the remainder. And if it happens that there is a one from which you had thus to take the one, remove it, and put a cypher there at least, lest the following figure should lose its value. And if it happens that there is a cypher where it [*i.e.* the subtracted figure] is to find its augmentation, then you must take the figure which follows; and when you come back again, cancel each cypher, and then write nine in front of it. Take away the second figure in the same manner as you have taken away the first.

158. *corr.* porait ? 176-7. *cf.* SB., p. 7, l. 18 : *Si major supponatur, tunc delectantur tot unitates quot contineat inferior figura et residuum loco ejus ponatur.* 178. *Ms.* meire. 186-7. *cf.* SB., p. 7, l. 27 : *ea deleta loco ejus scribatur cifra ne figuræ sequentes minus significant.* 191-3. *cf.* SB., p. 8, l. 1 : *et in redeundo, in loco cujuslibet cifræ pertransitæ ponatur figura nonenarii.* 192. *Ms.* De ch. c. fay.

- Enssi toutes les osterais,
 Tant que toutes osteis avrais.
 Et quant tu avrais tout subtrait,
 Si rajoust; se t'as bien fait,
 200 S'avras les figures devant;
 Ne mentirais ne tant ne quant,
 Car se as aleit droite voie,
 T'aras che que devant avoie.
- [IV] Duplication est quant ons puet
 205 Doubleir .i. nombre. *Et* si estuet
 Qui est a seniestre *comment*.
 Unc nombre y *convient* seulement.
 Et le premier doit doubleras,
 Et li nombre que t'en feras
 210 Ert *compos*, article ou dois. fo. 211b
 Se ch'est dois, *promier* faire dois
 En lieu de cel doit qu'i astoit
 Unc doit, qui les dois valeur doit.
 Se ch'est artycle, se dois faire
 215 Promier cyfre, *et* le doit defaire,
 Et après dois metre a senieste
 Le doit dont li artycles neste.
 Se li nombre *com* tu doblas
 Soit *compos*, tu *promiers* feras
 220 Le doit qui oultre l'article est,
 Et le doit del article mes
 A seniestre ensi *com* devant.
 Ensi vas tout adés faisant,
 Tant que trestot dobleit avrais.
 225 Et si diray que tu ferais
 Se cyfre y est : si n'*en* fais riens,
 Car cyfre ne fait ne .i. ne riens;
 De ly nulle riens ne ferais,
 Mains toute quoy le lairais.
- [V] 230 Dimidiation si est
 Quant d'on nombre li moitie est
 Ostce. Si doit ons a diestre
Commenchier, non pais a seneistre;
 Et une toute de figures

Thus you must take them all away, until every one is subtracted. And when you have subtracted the whole, add up again; if you have worked the sum properly, you will get back the original figures; you will not tell the least untruth, for if you have gone straight, you will get back what you had at first.

IV. Duplication is when one can double a number. It is necessary that what is on the left should begin. Only one number is required for it. You must double the first digit, and the number which you make from it will be a composite, an article, or a digit. If it is a digit, you should first write in place of that digit which was there a digit which is equivalent to the two. If it is an article, first a cypher must be written, and the digit cancelled, and then you must put on the left the digit which forms the article. If the number resulting from your doubling is a composite, you must first write down the digit which exceeds the article, and put the digit of the article on the left as before. Go on doubling everything thus, until you have doubled the whole. And I will tell you what to do, if there is a cypher in the number : do nothing with it at all, for a cypher does not represent one or anything at all; you must do nothing with it, but leave it entirely undisturbed.

V. Dimidiation is when the half is deducted from a number. One should begin on the right, not on the left; and a single set

202-3. *corr. droites voies and avoies* (cf. 266-7)? 234-5. cf. *SB.*, p. 9, l. 3 : *In mediatione autem tantum est unus ordo figurarum et unus numerus necessarius, scilicet, numerus mediandus.*

- 235 Y covient *sens* plus *par* droitures.
Celle qui tout promier serait
Ou .i. ou dois aultre ferait.
Se ch'est .i., si le dois defaire,
Et en son lieu cyfre refaire,
240 Et deseur signe de demi,
Ou .i. 'de', si le fiers parmi.
Se aultre dois que .i. estoit,
Ou peire ou nonpeire esseroit.
Le motie osteis, s'ilh est peire;
245 Et s'ilh n'est peire *main*s nonpeire,
Si oste le moitie de peire
Qui plus pres est sous le nonpeire.
Par l'uniteit qui deseur vient
Signe de demi faire *convient*.
250 Quant la *promier* fait avras,
A la seconde t'en yras,
Si le veras peire ou nonpeire.
S'ilh est peire, s'en dois osteire
La motie; et s'ilh avient
255 Que nonpeire soit, dont se *convient*
Osteir la moitie de peire
Qui plus pres est sous le nonpeire.
Ly uniteit qui remanra
Ou regart devant .x. vaura;
260 Des .x. les .v. osteir en dois,
Et les altres .v. faire dois
Aveque le doit *qui* est devant.
Ensi vas tout adés faisant.
Et quant ensi tout avrais fait,
265 Si le redouble tout afait,
S'avrais che que devant avoies,
Se tu as aleit droit voies.

of figures is all that is needed for it. The figure which comes first will be either one or some other digit. If it is a one, you should cancel it, and write in its place a cypher, with a 'half' sign above it, or a 'de' with a stroke through it. If it was any digit other than one, it would be either even or odd. Take away the half, if it is even; and if it is not even, but odd, take away the half of the even number which is nearest below the odd number. In respect of the unit which is left over, a 'half' sign must be written. When you have dealt with the first figure, you must go on to the second, and you will see it to be even or odd. If it is even, you should take away the half from it; and if it happens to be odd, then you must take away the half of the even number which is nearest below the odd number. The unit which is left will be worth ten in the preceding position; from the ten you should take away five, and you should add on the other five to the preceding digit. Continue to follow this method all the time. And when you have worked the whole of it in this manner, double the entire number obtained, and you will get back what you had originally, if you have gone straight.

238. i] Ms. iii. 243. Ms. efferoit. 245-7. cf. SB., p. 9, l. 25 : *Si impar, sume numerum proximum parem sub illo contentum, et medietatem ejus pone in loco illius imparis deleti.* 247. pres] Ms. peire (cf. 257); sous] Ms. sens. 249. Ms. Signour. 251. Ms. yuras. 252. Ms. feias. 257. sous] Ms. sor. 258-9. cf. SB., p. 10, l. 17 : *unitas autem quæ remanet medianda valet decem respectu figuræ præcedentis.* 259. Ms. venra. 261-2. cf. SB., p. 10, l. 20 : *et reliquus addatur figuræ præcedenti.*

[VI]

- Multiplication si est
 Quant .i. nombre multiplyét est
 270 Tant que quantes [fois] puit valoir
 Uns des dois nombres qu'en .i. avoir
 Com l'autre avoit de uniteis.
 Dois nombres par forche y meteis,
 L'un deseure, par teile maniere :
 275 La deraine sous la premiere.
 S'estuet *commenchier* a seniestre.
 La deraine desous doit estre
 Menée a cheli qui estoit
 Sor la *promier*, et se li doit
 280 Metre sour cheli tant de fois
 Dont .i. avoit, tout sens de fois.
 Après la seconde manrais
 A cheli meisme, si ferais
 Sour la seconde celle deson
 285 Tant fois com seconde at de .i.
 Ensi celle desous menrais
 A cel deseur. Et plus metrais
 Desous cheli qui après est
 Celle desous; et si le mes
 290 L'une après l'autre tout a fait,
 Et ensi com devant refait.
 Toutes celles desous menrais
 En la figure que mise as
 Sor le deraine de desos.
 295 Quant tes nombre serait fais tos,
 Si avras che *que* tu querois,
 Se tu as aleit chemien drois.
 Se cyfre est desos, si le mes
 Deseur li; ses lieu vuis est.
 300 S'elle [est] desus, si le trespasse,
 Et le figure après repasse,
 Et tes figure *avanchier* dois.
 Tout enssi adés faire dois.
 Qui bien multiplier vora,
 305 .vi. regles savoir *convenra*.
 La *promier* regle estre doit

VI. Multiplication is when a number is multiplied so that one of the two numbers may be worth as many times what the other contained (?) as the second contained units. Of necessity you must put down two numbers, one above the other, in this manner : the last [right-hand figure] beneath the first [left-hand figure]. One must begin on the left. The last figure underneath should be multiplied into that figure which was (*or* stands ?) over the first, and you should place that figure over it [the under figure] as many times as it [the under figure] contained units, without any hindrance. Next you must multiply the second figure into that same [upper] figure, and you must write the upper figure over the second as many times as the second contains units. Thus you must multiply the under figure into the upper number. And then you must put the under figure beneath the figure which comes next; and put them all similarly one after the other, and do again the same as before. You must multiply all those beneath into the figure which you have placed over the last of the under number. When your number is completed, you will have what you were seeking, if you have gone straight. If there is a cypher in the under number, put it [the cypher] above it [the multiplier]; its place is void. If there is one in the upper number, pass it by, pass the following figure also, and you should move your figures forward. You should continue the operation in this manner.

If one wishes to multiply accurately, one must know six rules.

268-72. cf. SB., p. 12, l. 6 : *Multiplicatio... propositis duobus numeris, est tertii inventio qui contineat alterum illorum quot continentur unitates in reliquo.* 271. Ms. nombres. 272. Ms. Com est lautre. 274-5. cf. SB., p. 13, l. 27 : *ita tamen quod prima figura inferioris ordinis sit sub ultima superioris.* After 274 a verse beginning *Lautre derain* (rest illegible) has been struck out with red ink. 277-9. cf. SB., p. 13, l. 29 : *Hoc facto, ducenda est ultima multiplicantis in ultimam multiplicandi.* 283. si] Ms. trois. 292. Ms. metrais. 300-2. cf. SB., p. 15, l. 16 : *Si autem contingat quod cifra sit inter primam figuram et ultimam multiplicandi, anteriorandus est ordo figurarum per duas differentias.* 300. S'elle] Ms. Celle.

- Quant doit multiplie le doit;
 Ou doit l'article multiplie,
 Ou dois le conpos multiplie,
 310 Article multiplie article
 Ou *compos*, conpos le ticle.
 Se li dois multiplie dois,
 Donc *promerain* regarde[ir] dois fo. 211d
 Combien li plus grans dois
 315 Menre de .x. est; puis si dois
 Le meneur tant fois osteir
 Del article menre, et gardeir
 Combien ilh poroit remanoir,
 Car li nombre vuet tant valoir.
 320 Se li dois multiplie article,
 Si prendre le dois del article
 Et le doit qu'avoies devant,
 Pius vas entre eaux multipliant;
 Et tant donke *com* tu en avrais,
 325 Tant de .x. tes nombre ferais.
 Se *compos* multiplie dois,
 Tu del article prendre dois
 Aveque le doit *com* tu avois,
 Et se le maine droit voies;
 330 Et tant .i. *que* tu avrais d'eaux,
 Tant de .x. si feront entre eaux.
 Li doit qu'oultre l'article astoit
 Multiplie a *promerain* doit,
 Et tant *com* de .i. y avrais,
 335 Tant donk *aveque* les .x. ferais.
 S'article multiplie article,
 Si prendrais les dois des articles,
 Entre eaux les multiplirais;
 Et tant .i. *com* tu en avrais,
 340 Tant de cens tos tes nombres fait.
 Nulle riens plus ne mains n'y fait.
 S'article multiplie *compost*,
 Les dois des articles *prends* tost,
 Et tant .i. *com* d'andois venra,
 345 Tant de cens tes nombres fera.

The first rule applies when a digit multiplies a digit; or a digit multiplies an article, or a digit multiplies a composite, an article multiplies an article or a composite, a composite [multiplies] another composite. If a digit multiplies a digit, then you should first consider by how much the greater digit is less than ten; then you should take away the lesser digit that number of times from the lesser article [*i.e.* the article formed by the lesser digit], and see how much there may remain, for the required number will be that amount. If a digit multiplies an article, take the digit of the article and the digit which you had at first, then multiply them together; and whatever the amount produced by this multiplication, your total will be ten times as much. If a digit multiplies a composite, you should take [the digit] of the article and the digit that you have already, and multiply them in the correct manner (?); and whatever number of units you obtain from them, they will make ten times as many between them. Multiply the digit following the article into the first digit, and whatever number of units you obtain, you must then add it on to the tens. If an article multiplies an article, you must take the digits of the articles and multiply them together; and whatever number of units you obtain from them, your total number is one hundred times as much. Do nothing more or less in this operation. If an article multiplies a composite, take quickly the digits of the articles, and whatever number of units results from these two, your total will amount to one hundred times as much. Then take the digit following

307. Quant] *Ms.* Qui; *Ms.* multiplier. 308. *Ms.* multiplier. 315. *Ms.* Mere. 317. menre] *Ms.* metre (*cf.* 292). 321. *corr.* Si prens or Prendre dois? 326-35. *cf.* *SB.*, p. 13, l. 3 : *Quando autem digitus multiplicat numerum compositum, ducendus est digitus in utramque partem numeri compositi, ita quoddigitus in digitum per primam regulam, et digitus in articulum per secundam regulam; postea producta conjungantur simul et erit summa totius multiplicationis.* 326. *Ms.* multiplier. 327. Tu] *corr.* Cel? 329. le] *corr.* les?; voies] *Ms.* viues (*cf.* 267). 332. *Ms.* qui autre article (*cf.* 148, 346).

- Pius [prens] le doit d'oultre l'article
 Et le doit del premier article,
 Entre eaux les multiplierais;
 Et tant .i. que tu en avrais,
 350 Tant de .x. ton nombre ferait,
 Aveque les cens que devant ait.
 Se *compos* conpost multiplie,
 Prens le doit de cascunne article,
 Entre eaux les multiplierais;
 355 Et tant .i. *com* tu en avrais,
 Tant de cens avrais. Pius *prens* toist
 Le doit dont li .i. est conpoist,
 Avoit le doit de l'autre article
 Multiplie ensemble le ticle;
 360 De l'autre article *prens* le doit
 Et de l'autre *compos* le doit,
 Entre eaux les multiplierais;
 Quans .i. y at, tant .x. avrais.
 Pius *prens* des dois *compos* les dois,
 365 Entre eaux multiplier les dois; fo. 212a
 Et tant .i. *com* [des] dois avrais,
 Tant aveque ton nombre avrais.
 Qui chi unc pou penseir vora,
 Tantoist multiplier sara.
 [VII] 370 Division est quant ons puet
 Avoir dois nombres, *et* s'estuet
 Unc nombre de ches dois troveir
 Que ons tant de fois puist osteir
 De plus grant nombre c'on avoit
 375 *Com* ou menre de .i. avroit.
 A mains de dois nombre ons ne puet.
 Le meneur desous faire estuet.
 Si dois *commenchie* a seniestre,
 Et la deraine figure estre...
 380 Cascunne ensi mise estre doit.
 En dois cas no regle feroit :
 Quant [c]elle deseure serait
 Menre que celle desous n'est,
 Ou quant celle qui après est

the article and the digit of the first article, and multiply them together; and whatever number of units you obtain from this multiplication, your total will amount to ten times as much, to be added to the hundreds already there. If a composite multiplies a composite, take the digits of each article and multiply them together; and whatever number of units you obtain from them, your total will be so many hundreds. Then take quickly the digit which forms part of one composite, multiply this figure with the digit of the other article; take the digit of the other article and the digit of the other composite, and multiply them together; whatever number of units results, your total will be so many tens. Then take the digits of the two composites, and you should multiply them together; and whatever number of units you obtain from the two, that number you must add to your total. He who will ponder a little upon these instructions will forthwith know how to multiply.

VII. Division is when one can have two numbers, and it is necessary to find from these two a number which can be taken away from one's greater number as many times as there are units in the lesser. With less than two numbers the operation is impossible. The lesser number must be written underneath. You should begin on the left, and the last figure [should] be..... Each figure should be placed thus. In two cases our rule [of putting the last figure of the divisor beneath the last of the dividend]

350. x.] *Ms.* cens; ton] *Ms.* con. 353. de] *Ms.* da. 358. Avoit] *corr.* Avuec?
 360. *Ms.* et prens. 367. avrais] *corr.* ferais (*cf.* 335)? 370-5. *cf.* *SB.*, p. 16,
 l. 1: *Divisio numeri per numerum est, propositis duobus numeris, majorem in tot
 partes distribuere quot sunt unitates in minori.* 375. ou menre] *Ms.* .i. mere (*cf.*
 315). 381. *corr.* farait ?

- 385 Tant de fois ne puet estre ostee
 Com celle devant est rostee.
 Adonc toy dis que tu ferais :
 Sous celle après le meterais.
 Après si dois tu regarder
 390 Quant fois ons porait osteir
 Cheli desous de cel desu.
 Mains en teile maniere dois tu
 Chel osteir qui *promeraine* est,
 Que cel oussi qui après est
 395 Puist ostee estre tant de fois
 Com cel devoit. Et puis dois,
 Sens la deraine a main diestre,
 Quantes fois les ostas, dols mestre,
 Après chu figureir de mes
 400 Sor la figure qui après est.
 Pius dois osteir cel[es] desous
 De celes deseur tous
 Tant de fois *com* tu porais;
 L'une tant *com* l'autre osterais.
 405 En hault tant .i. faire t'estuet
 Quantes fois osteir ons le puet.
 Quante toutes osteir tu ne poras,
 Tu en hault .i. cyfre feras;
 Après teis figure ramenche,
 410 Et *com* devant faire *commenche*,
 Tant *que* li figure promiere
 Soit tout droit desous la *promiere*.
 Nulle figure n'en osterais
 Plus de .ix. fois ; mains osterais
 415 Ches figures l'une après l'autre,
 Et autretant l'une *com* l'autre. fo. 212b
 Et quant ostee les avrais
 Tant de fois *com* tu saverais,
 S'acune chouse remeise est
 420 De nombre, si fais menres est;
 Car s'ilh eust ensi grans esteit,
 Tos li nombre seroit osteit.
 Mains que remeis en serait

would fail : when the upper figure is less than that beneath, or when that figure which follows cannot be taken away as many times as the preceding figure has been. I tell you what to do in such cases : you must put it [the last figure of the divisor] under the figure which follows. Next you should consider how many times one can take away the under from the upper figure. But you should take away the figure which is first in such a manner that the figure which follows can also be taken away as many times as the former was to be. Then, omitting the last figure on the right, you should next indicate, in addition (?), dear sir, above the figure which follows, how many times you took them away. Then you should take away all the under figures from those above as many times as you can; you must take then away, one and all. Above you must write as many units as the number of times one can take them away. When you cannot take them all away, you must write a cypher above; then move forward (?) your figures, and begin to do as before, until the first figure [of the divisor] is directly beneath the first [of the dividend]. You must not take away any figure more than nine times; but you must take away these figures one after another, and the one figure just as much as the other [*i.e.* not only the first figure of the divisor, but also the figures following it]. And when you have taken them away as many times as you can, if anything of the number is left over, it is made less [than the divisor]; for if it had been as large [as the divisor], the whole number would have been taken away.

385. *Ms.* defois. 388. Sous] *Ms.* Sor. 394. oussi] *Ms.* ensi. 395. estre] *Ms.* estue. 396-400. *cf.* *SB.*, p. 17, l. 7 : *scribendus est numerus denotans quotiens ex directo supraposito illius figuræ sub qua est prima figura numeri divisoris.* 402. De] *Ms.* Et. 409. *cf.* *SB.*, p. 17, l. 16 : *et anteriorandæ sunt figuræ.* 412. *written after* 413, *an angulated line indicates its proper place.* 422. seroit] *Ms.* erent.

- Mult bien gardeir le *convenrait*.
 425 Le menour multiplierais
 Aveque cheli que troveit ais;
 Pius adjoste le remanant,
 Si avrais chu qu'avoies devant.
 Et s'ilh avient qu'ilh toy remangne
 430 Des cyfre, fais en ton ovrangne
 Ensi bien *com* se fuissent dois,
 Car tout ensi faire le dois.

[VIII]

- Progression est quant ons *compte*
 Nombre tout affair en .i. monte
 435 Combien la *somme* toute fait,
 Et quant en peire ou nonpeire lait;
 Ou ons *prent* trestos les nonpeire,
 Ou ons lait trestos les nonpeire.
 En .ix. manieres en y at,
 440 Que par regle savoir porat.
 Ou ch'est nombre trestot affair,
 Ou entre dois, ou ons en lait.
 Se li *nombre* tout a fait est,
 Li *fins* est peire, ou nonpeire est.
 445 S'en peire finist, la motie *prent*,
 Et li *nombre* après le fin *prent*,
 Si les multiplie, si avrais
 Tres bien chu que demanderais.
 Et s'ilh diffinist en nonpeire,
 450 La plus grant part *prens* de nonpeire
 Qui est plus pres de la moitie,
 Et après si le multiplie
 A la fin que devant avois,
 Si avrais chu *que* tu *querois*.
 455 Se tu vues savoir tos les peires,
 Si *prens* la motie des peires
 Et le nombre après la motie,
 Et tantoist si les multiplie,
 Si avrais che que demandas,
 460 Se bien multiplyét les as.
 Se tu vues savoir des nonpeire,
 Si *prens* le fin de tes nonpeire,

But what is left of the number must be carefully preserved. You must multiply the smaller number with that which you have obtained; then add on the remainder, and you will get back what you had originally. And if it befalls that any cyphers are left over, act in your calculation just as though they were digits, for that is how you should proceed.

VIII. Progression is when one reckons up into a single total a series of numbers, to find out the sum of them all, or the sum when one leaves out even or odd numbers; one may either take all the odd numbers, or one may leave out all the odd numbers. There are nine (?) manners of doing this operation, which you can learn by rule. It is either an entire series of numbers, or a series between two numbers, or a series in which some numbers are omitted. If the series of numbers is entire, the final number is either even or odd. If the series ends in an even number, take half of it, and take the number which follows the final number, multiply them together, and you will obtain exactly what you want. If it ends in an odd number, take the larger part, nearest to one-half, of the odd number, and then multiply it with the final number that you had before, and you will obtain what you were seeking. If you wish to know [the sum of] all the even numbers, take the half of the even numbers and the number following the half, and forthwith multiply them, and you will obtain what you wanted, if you have multiplied them correctly. If you wish

433. *Progressio in right margin.* 433ff. cf. *SB.*, p. 18. 436. en] *corr.* ons ?
 445. S'en peire] *Ms.* Sens plus. 447. *Ms.* Sens multiplyer. 458. *Ms.* Est t.
 et les m.

- Et si le pars en dois moities;
 Et *prens* la plus *grant* parties,
 465 Se le multeplie par li,
 Si avras chu *que* tu as qui.
 Deseur mais en pais vou laray,
 D'algorisme plus ne diray.
 Mains le bien s'entendut aveis,
 470 Tout che qu'oyt dire m'aveis,
 N'est *riens* de *nombre* c'*on* puist dire
Que vos ne seussies tantoist dire.
 De studoier estre songneux
 Doit estre li hons *qui convoiteux*
 475 Est d'*aprendre*; car li estude
 Fait plus savoir c'*on* ne cuide,
 Et retenir c'*on* ne pense.
 L'estude est une despanse
 Et unc tressorie *qui* tot plain
 480 Est de joweais de trestos clain,
 Et *prendre* n'*en* y seit ons tant
 Que ons le voise amenrissant.
 Car quant .i. clerc at estudiet,
 Et la *scienche* *qui* li siet,
 485 Tant *qu'ilh* en at plaine sa tieste,
 A la *scienche* n'at fait molieste;
 N'a l'estude de riens vuidiet
 De chu *qu'ilh* en at conchiet;
 Or *tant* en demeure en l'estude
 490 *Com* devant, si *com* je cuide.
 Si *prions* Dieu par sa piteit
 D'estudoier la volenteit
 Nos *donne*, et si bone *scienche*
 Que nos menons en *conscienche*
 495 Toudis de faire le sien plaisiere :
 Amen, si *com* je le desire.

fo. 212c

to know [the sum] of the odd numbers, take the last of your odd numbers and divide it into two halves; take then the larger part and multiply it by itself, and you will have what you sought after.

Henceforth I will leave you in peace, and say no more of algorism. But if you have understood all the good that you have heard me say, there is no arithmetical problem that can be mentioned which you could not at once answer. The man who is eager to learn should be careful to study; for study causes one to know more than one thinks, and to retain [in one's mind] more than one realizes. Study is a store and a treasury which is quite filled with jewels of all kinds, and one can never take so much from it as to cause it to dwindle. For when a clerk has studied in the learning which suits him, to such an extent that his head is full of it, he has done no hurt to the learning; he has in no degree exhausted study because of the amount of it that he has mastered; now let him persist in his study to the same extent as before, so it seems to me. Let us then pray God by his pity to grant us the will to study, and learning so good that we may always lead our lives with the intention of doing his pleasure. Amen, such is my desire.

WORD-LIST.

[Technical terms, other words of lexical interest, and a few forms not explained in the Introduction are included. Square brackets indicate that an emendation has been introduced. An asterisk indicates that the meaning adopted is not mentioned in the dictionaries of TOBLER-LOMMATZSCH (down to *cl-*) or GODEFROY (from *co-*).]

- abaque, *s.* 10.
 aconstumer, *v. a. bring into use* 45.
 addition, *sf.* 107, 118.
 adés, *adv. at once* 81; *still* 89; *all the time, continuously* 223, 263, 303.
 adjousteir 118, 129, -osteir 152 ff., 427, *v. a.*
 afait, *aff-* *see* tout.
 afature, *sf. preparation, (hence) equipment* 38; *cf. afaitier, to make ready.*
 algorithme, *s.* [1], 24, 468.
 [amenrir], *v. a. diminish* 482.
 *andois, *both* 344.
 apairier, *v. a. make a pair, unite* 135.
 arismetique, *s.* 7.
 article, *sm. number completely divisible by ten* 92, 96, etc.
 *bon, *adj. of good omen, right (hand)* 51.
 *clain, *sm. designation, (hence) class, kind* 480; *cf. clamer, to designate.*
 comment, *subj. pr. 3 sg. of commenchier, v. n.* 206.
 *compos 92, etc., con- 311, etc., compost 342, con- 352, conpoist 357,
adj. composite 98; *sm. number of more than one figure, not completely divisible by ten.*
 compte, *sm. calculation* Prol., 3, 33, 144; *set of figures, number* 16.
 conchier, *v. a. (used figuratively)* 488.
 *conscience, *sf. mind* 20, 494.
 cyfre 14, 62, 140, etc., chiffre 38, *sf. cypher, nought.*
 debautre, *v. dispute*, 15.
 defaire, *v. a. suppress, cancel* 133, 142, 174, [192], 215, 238.
 defois, *sm. prohibition* 281.
 deseur, *adv. henceforth* 467.
 *deson, *adv. above* 284; *not in Godefroy.*
 despense, *sf. provision, store* 478.
 desquent, ? 9.
 devantrain, *adj.* 49.
 devise, *sf.* ? 66.
 deviseir, *v. divide* 17, 99.
 diffinir, *v. n. end* 449.
 *dimidiation, *sf.* [110], 230.

- *dire, *v. a. tell (a number), place in its order* 125.
 division, *sf.* 112, 370.
 dobleir, dou-, *v. a.* 205, 208, 218.
- *dois, doit, *sm. digit* 91, 141, etc.
 droite voie 202, droit voies 267, [329], *adv. straight (used figuratively)*.
 *duplication, *sf.* 109, 204.
- ensyet Prol., ensiete 109, *ind. pr. 3 sg. of ensiere* (Fr. ensiwre, ensuivre),
v. refl.
- *espise, *s. subdivision, operation* (Lat. species) 104.
- *estudoier 492, stu- 473, *v. n.*; no example having this suffix is given
 by Godefroy.
- *faire (aveque), *v. a. add* 261, 335, *cf.* 367.
 faroit, *cond. 3 sg. of faure* (Fr. faillir) 381.
 figure, *sf.* 14, 37, 48, etc.
 figureir, *v. a. indicate, write down* 399.
- hoir = hors *adv.* 159.
- jointe, *sf. augmentation* 189.
 jointure, *sf. union, combination* 13.
 jowecais = Fr. joiaus, joyaux, *s.* 480.
- *leveir, *v. a. accomplish, effect (?)* 33.
- maine, *ind. pr. 3 sg. of mneir, v. a.* 329.
 manrais, *fut. 2 sg. of meneir, v. a.* 282.
 mathematique, *adj.* 8.
- *mencir, *v. a. multiply* 278, 282, 286, [292], 329; *v. refl. conduct one-
 self* 494.
 mes, *adv.*; *de m., *in addition, also (?)* 399; *cf.* de plus, de mieuz, de
 pis (TOBLER, *Vermischte Beiträge, II, 2nd edition, pp. 62 f.*).
- *metre, *v. a. employ (?)* 2.
 molieste, *s.*; faire m. a, *trouble, harm* 486.
 monte, *sm. heap, (here) total* 434.
 multiplication, *sf.* 111, 268.
 multiplier 15, 269, etc., -plier 309, etc., -teplier 342, *v.*
- nest 179, neste 217, *ind. pr. 3 sg. of naistre*.
- *nombre, *sm. system of numbering or reckoning* 1, 2, 7, 104.
 nonpeire, *adj. odd (number)* 243, etc.
 numeration, *sf.* 106, 114.
- ouwetemme, *eighth* 113.
 ovrangne, *s. task* 430.
- *parfait, *adj.*; nombre p. 161.

- peire, *adj. even (number)* 243, etc.
- *progression, *sf.* 113, 433.
- promerain, *adv.* 313.
- promier, *adv.* 147; a p. 65, 72, 85; al p. 137.
- puir, *subj. pr. 3 sg. of pooir* 270.
- *racompteir, *v. count again* 79; *cf. reconter, recompter in Godefroy.*
- rajousteir, *v. add again* 199.
- ramanant 183, rem- 427, *sm.*
- ramenche, *imperat. 2 sg. of rameneir* 409.
- reclout, *ind. pr. 3 sg. of reclore* 20.
- redoubleir, *v.a.* 265.
- *regart, *sm. position* 259; *cf. ou r. desous in the algorism published by*
C. MORTET (*Bibl. Mathematica, ser. 3, vol. IX, 1908*), p. 62, l. 3.
- repoiseir, *v. a. place* 163.
- [risme], *s.* 25.
- rostece = re, *in one's turn*, + ostee 386.
- scienche, *sf.* 8, 19, 484, etc.
- subtilh Prol., *nom. -is* 5, *adj. subtle, precise, accurate.*
- subtiliteit, *s. accuracy* 22.
- subtraction, *sf.* 108, 156.
- subtraire, *v. a.* 198.
- *ticle, *sm. ?* 311, 359; *appears to be an expression substituted, to avoid repetition, for a word just used* (conpos 311, doit 359).
- tout a fait 290, 443, t. afait 265, t. affait 434, trestot affait 441, *all, the whole*; *cf. Godefroy III, 708a a fait.*
- *toute, *sf. set (of figures)?* 234; *perhaps corrupt.*
- traitier, *sm. treatise* 28.
- [tressorie], *sm. treasury* 479.
- unité 180, -teit 248, 258, 272, *s. unit.*
- *vaqueir, *v. n.* 9; = *Lat. vacare ?*
- viereis, *fut. 2 pl. of veoir, v.* 35.
- voise, *subj. pr. 3 sg. of aler, v. n.* 482.
- vora, *fut. 3 sg. of vouloir, v. n.* 304, 368.
- vuidier, *v. a. exhaust* 487.

(Oxford.)

E. G. R. WATERS.

Une lettre inédite de Newton *

« this shining spirit, who pointed out, as none before or after him did ».

(A. EINSTEIN)

La lettre de NEWTON qu'avec la bienveillante autorisation de Mr. le Conservateur des Manuscrits du British Museum nous avons l'honneur de présenter au public est inédite. Elle fut acquise le 29 juin 1904 à une vente chez Messrs. SOTHEY & C^o et fait partie d'une collection d'autographes divers catalogués sous le N^o 37.021 (f. 56). Son intérêt réside surtout dans la manière tout à fait moderne — moins sans doute en ce qui concerne la forme que l'esprit — dont y est traité un problème d'une extrême difficulté. En outre, sa publication comble une importante lacune de la correspondance entre NEWTON et HOOKE (1) reproduite par W. W. ROUSE BALL dans son ouvrage *An Essay on Newton's Principia* (2) auquel le lecteur pourra très utilement se référer (3).

On sait, de l'aveu même de NEWTON, l'importance qu'eut pour lui cet échange de lettres (4) : ce fut réellement le point de départ de nouvelles recherches particulièrement conséquentes en raison de l'application à la mécanique céleste des résultats obtenus. Afin de permettre une lecture aisée du document que nous avons

(*) Cet article était déjà écrit lorsque, au cours d'un nouveau séjour en Angleterre, nous avons retrouvé le journal inédit de HOOKE. Nous sommes heureux de pouvoir dès à présent publier ici les passages de ce *diary* relatifs aux lettres de NEWTON.

(1) NEWTON et HOOKE écrivent indifféremment HOOK et HOOKE.

(2) London, MACMILLAN & C^o., 1893 : cf. spécialement pp. 19 et 146.

(3) Cette lettre éclaire également d'un jour nouveau la correspondance avec HALLEY (mai 1686-juillet 1687) : ROUSE BALL, *loc. cit.* pp. 153-174; cf. aussi la lettre de AUBREY et HOOKE à A. WOOD (15 sept. 1689) : S. P. RIGAUD, *Historical Essay on the first publication of Sir Isaac Newton's Principia*, Oxford, 1838, app. p. 52.

(4) « This is true, that his letters occasioned my finding the method of determining figures, which when I had tried in the ellipsis, I threw the calculations by, being upon other studies » (lettre à HALLEY, 14 Juillet 1686).

eu la bonne fortune de retrouver, nous allons indiquer sommairement les circonstances dans lesquelles il fut écrit.

* * *

Celle des correspondances successives et intermittentes entre NEWTON et HOOKE qui nous intéresse, semble comprendre sept lettres, trois de NEWTON et quatre de HOOKE, dont l'une manque seule à présent. (5)

De 1671 à 1676, rien ne révèle l'activité de NEWTON dans le domaine des mathématiques; l'année 1677 marque le point culminant de sa querelle avec HOOKE, provoquée à la fois par des questions de priorité et des divergences dans l'interprétation par la théorie de l'éther des expériences d'optique entreprises par les deux savants; ceux-ci sortaient considérablement aigris de cette polémique stérile qui n'était d'ailleurs pas la première (6). De plus, le caractère pratique des inventions et des recherches de HOOKE, que dévorait un vif désir de gloire, donnait à ses travaux purement scientifiques un aspect d'improvisation et d'inachèvement et dégageait une impression de romantisme qui ne pouvait que déplaire à NEWTON, savant essentiellement classique dans l'acception d'OSTWALD (7). Voici comment plus tard, dans une lettre à HALLEY (20 juin 1686) NEWTON s'exprimera

(5) Toutefois, d'après le journal de HOOKE (10 mars 167 $\frac{1}{2}$ -15 mai 1683) que nous venons de découvrir à la Library of the Corporation of the City of London, deux autres lettres — peut-être de simples billets — auraient été échangées. Ce journal nous fournit également les dates des expériences tentées par HOOKE.

Décembre 1679

Fryd. 5 ... D. H. wrote to Mr. NEWTON.

... Sund. 7. wrote Journall. D. H. NEWTON's Letter. Jonathan.

... W. 24 ... Read NEWTON's Letters to BOYLE at Garways.

Janvier 1680

... Fry. 16 ... tryd fall of Bullet in y^e hall (wth success) (cf. la lettre de HOOKE à NEWTON, 17 janvier, ROUSE BALL, *loc. cit.*, p. 149)

... M. 26 ... tryd perpend. expt.

(6) Cf. *Memoirs of the life, writings, and discoveries of SIR ISAAC NEWTON*, by SIR DAVID BREWSTER, Edinburgh, CONSTABLE & Co, 1855 : vol. I, p. 78, et la lettre de NEWTON à HALLEY, 20 juin 1686 : « ... this is the third time that he has given me trouble in this kind ». NEWTON parle ici de la querelle qui va résulter, comme on le verra plus loin, de sa correspondance avec HOOKE (1679-80).

(7) Dans une étude sur NEWTON et la pensée anglaise qui paraîtra prochainement, nous avons recherché dans quelle mesure il est possible d'appliquer les théories de l'illustre philosophe allemand aux savants anglais du dix-septième siècle.

sur le compte de HOOKE : « Should a man who thinks himself knowing, and loves to show it in correcting and instructing others, come to you, when you are busy, and notwithstanding your excuse press discourses upon you, and through his own mistakes correct you, and multiply discourses; and then make this use of it, to boast that he taught you all he spake, and oblige you to acknowledge it, and cry out injury and injustice if you do not; I believe you would think him a man of strange unsociable temper. » (8)

NEWTON ne s'absentait guère de Cambridge, où il vivait dans une quasi solitude. C'est à cette sédentarité que l'on doit une volumineuse correspondance dont cependant des parties considérables sont perdues.

HOOKE qui succédait à OLDENBURG comme Secrétaire de la Royal Society (25 octobre 1677) adresse le 24 novembre 1679, au nom de celle-ci, une première lettre extrêmement courtoise à NEWTON : « ...I hope therefore that you will please to continue your former favours to the Society by communicating what shall occur to you that is philosophicall... » Puis, après une allusion aux intrigues réelles ou imaginaires qui auraient tendu à le brouiller autrefois avec NEWTON, HOOKE ajoute ceci : « For my part I shall take it as a great favour if you shall please to communicate by letter your objections against any hypothesis or opinion of mine; and particularly if you will let me know your thoughts of that of compounding the celestiall motions of the planetts of a direct motion by the tangent and an attractive motion towards the centrall body... » HOOKE termine en mettant son correspondant au courant des résultats de diverses missions scientifiques et lui signale quelques travaux récemment parus.

La réponse de NEWTON à HOOKE date du 28 novembre 1679.

Journal de HOOKE :

munday, DECEMBER 1 ...Letter from NEWTON & BEALE.

Cette lettre assez longue (manuscrit R-4-48 de la bibliothèque de Trinity College Cambridge) a été publiée pour la première fois par ROUSE BALL (9); il y en a quelques passages toutefois

(8) En dépit du jugement sévère de NEWTON, on ne peut se défendre d'un sentiment de pitié à l'égard de HOOKE qui, en raison de ses difformités physiques notamment, traîna une existence en tous points misérable. •

(9) ouvrage cité, pp. 141 et sq.

sur lesquels nous croyons utile d'attirer encore l'attention.

Le ton de cet écrit est d'une courtoisie qui paraît presque excessive. Mais NEWTON attache un trop grand prix à sa tranquillité pour consentir à renouer des relations avec son ancien adversaire (10). Aussi insiste-t-il sur le fait qu'il ne s'occupe plus guère de sciences, et ce délaissement n'est pas feint : « But yet my affection to philosophy being worn out, so that I am almost as little concerned about it as one tradesman uses to be about another man's trade or a country man about learning, I must acknowledge my self avers from spending that time in writing about it which I think I can spend otherwise more to my own content and the good of others : and I hope neither you nor any body els will blame me for this aversness ».

« ...I had for some years last been endeavouring to bend myself from philosophy to other studies in so much that I have long grutched the time spent in that study unless it be perhaps at idle hours sometimes for a diversion » ; il ne s'agit peut-être pas seulement ici des travaux de laboratoire et d'exégèse auxquels NEWTON consacrait un temps considérable, mais des travaux juridiques qu'il avait également entrepris. On sait aujourd'hui que peu d'années avant 1679, NEWTON, excédé par des disputes incessantes et effrayé du grand nombre de ses contradicteurs, avait songé à abandonner la science pour solliciter une chaire de droit.

A propos des hypothèses cosmogoniques de MALLEMENT, NEWTON écrit : « The readiest way to convince the world of this truth would be I conceive to set forth first in some two of the planets, suppose Mars and the earth, a specimen thereof *stated and determined in numbers*. » Ces derniers mots expriment de fort heureuse façon l'idée qui est à la base de l'œuvre newtonienne : la traduction dans le langage mathématique des faits d'expériences et le contrôle des hypothèses ainsi réalisé en toute sûreté.

La partie de la lettre qui commence par ces mots : « In requital of this advertisement... » constitue, en dépit de la négligence de

(10) « In my answer to his first letter I refused his correspondence, told him I had laid philosophy aside, sent him only the experiment of projectiles (rather shortly hinted than carefully described), in compliment to sweeten my answer, expected to hear no further from him ». (Lettre à HALLEY, 20 juin 1686).

l'exposé (11), un magnifique exemple de la conception d'un problème scientifique chez NEWTON; c'est ce qui en fait au point de vue philosophique l'incalculable valeur; ce passage établit en outre la priorité de NEWTON dans le calcul de la déviation des graves. Certes, avant lui, « TYCHO-BRAHÉ, dans son *De mundi aetherei recentioribus phaenomenis* (1588-1610) avait indiqué comme objection principale contre la rotation de la terre, qu'une pierre tombant sur le côté ouest d'une tour devait dévier à l'ouest de la verticale, « car pendant sa chute la terre fuit sous elle vers l'est! » (12) GALILÉE (13) soupçonna une déviation vers l'est et ne semble pas, au surplus, avoir trouvé d'arguments s'opposant à la démonstration de la rotation axiale de la terre. LÉONARD DE VINCI posa nettement le problème quoique probablement convaincu de l'immobilité de la terre. Mais, il faut bien le reconnaître, les méthodes de la science positive font défaut chez ces précurseurs; les bases théoriques sont vagues, les recherches expérimentales nulles. « In the way of actual justification of our confidence in the existence of an entirely physical causality, virtually nothing had been achieved before NEWTON, who was placed by fate at a turning-point in the world's intellectual development » (14).

NEWTON, qui qualifie modestement son travail de « fancy of my own » explique qu'un corps lâché d'une certaine hauteur « will shoot forward to the east side of the perpendicular describing in its fall a spiral line (15), ADEQ (16), quite contrary to the opinion of the

(11) Cette négligence concerne surtout la forme; au contraire, certains détails de l'expérience proposée par NEWTON révèlent un sens admirable de l'importance relative des causes d'erreurs dont HOOKE allait avoir à tenir compte au cours de l'expérimentation, par exemple la dissymétrie causée dans les couches d'air du puits par la chute de la bille : « for in a narrow well the bullet possibly may be apt to receive a ply from the straitened air neare the sides of the well, if in its fall it come nearer to one side than to another ».

(12) EDM. HOPPE, *Hist. de la Physique*, 1928 p. 54.

(13) *Opere di GALILEO GALILEI*, vol. 7, 1897, pp. 170 et 259.

(14) A. EINSTEIN : ISAAC NEWTON, *the Observatory*, May 1927.

(15) J. G. HAGEN (S. J.) dans son ouvrage « *La Rotation de la Terre, ses preuves mécaniques anciennes et nouvelles*, Rome, 1911 » a cru devoir commenter comme suit le texte de NEWTON : « L'idée de dessiner cette spirale peut lui avoir été suggérée par un passage de l'*Epitome Astronomiae Copernicanae* de KÉPLER, paru en 1618 (*Opera omnia*, VI, 1, 1865 p. 182) où est représentée une courbe ressemblant à une spirale. Le sens que KÉPLER attachait à cette courbe est assez incertain, mais pourrait peut être s'éclairer par des passages d'auteurs antérieurs à COPERNIC. LÉONARD DE VINCI s'était occupé du problème suivant : « Du grave

vulgar who think that, if the earth moved, heavy bodies in falling would be outrun by its parts and fall on the west side of the perpendicular ». La deuxième partie de cette phrase constitue probablement une allusion à l'opinion de TYCHO, citée plus haut. Notons qu'en 1679 la rotation de la terre était loin d'être admise par tous. Qu'on nous permette en outre de rappeler ici que c'est le 11 septembre 1822 que la Congrégation de l'Inquisition, approuvée par PIE VII, autorisa la publication des livres enseignant le mouvement de la terre.

La lettre de NEWTON fut lue à la Royal Society le 4 décembre; WREN et FLAMSTEAD émirent des observations.

Le passage que nous avons en partie reproduit, relatif à la déviation due au mouvement diurne, ainsi que la figure dessinée par NEWTON lui-même paraissent attester que le futur auteur des Principes croit que le corps va tomber au centre de la terre suivant une trajectoire spirale (17).

La réplique de HOOKE à NEWTON (9 décembre 1679) est perdue; elle fut lue à la Royal Society le 11 décembre.

Journal de HOOKE :

descendant dans l'air, les éléments étant animés d'un mouvement de circonvolution dont l'entière révolution a lieu en 24 h. » Le texte est accompagné d'une sorte de spirale qui commence « de la partie la plus élevée de la sphère du feu » et se termine à la surface de la terre. Le but de cette figure est de montrer que la « trajectoire du grave », bien que rectiligne, absolument parlant, prend en apparence la forme d'une spirale, par suite de la rotation des sphères célestes. La spirale de LÉONARD est reproduite et expliquée dans un ouvrage récent de P. DUHEM, *Etudes sur Léonard de Vinci, ceux qu'il a lus et ceux qui l'ont lu*, Paris 1908, 2^e série, pp. 252-255 ».

(16) Voir la figure, ROUSE BALL, loc. cit., p. 142.

(17) « I thought no further of philosophical matters than his letters put me upon it, and therefore may be allowed not to have had my thoughts of that kind about me so well at that time » (lettre à HALLEY, 20 juin 1686). « I sent him this notion, that a falling body ought by reason of the earth's diurnall motion to advance eastward and not fall to the west as the vulgar opinion is. And in the scheme wherein I explained this I carelessly described the descent of the falling body in a spirall to the center of the earth : which is true in a resisting medium, such as our air is » (lettre à HALLEY, 27 mai 1686). En outre, dans sa lettre suivante au même (20 juin 1686), NEWTON écrit : « I never extended the duplicate proportion lower than to the superficies of the earth, and before a certain demonstration I found the last year, have suspected it did not reach accurately enough down so low... But it sufficiently explains to you, why in considering the descent of a body down to the centre, I used not the duplicate proportion... For his extending the duplicate proportion down to the centre (which I do not) made him correct me ».

Tu. 9... Sent L. to NEWTON BEAL.

HOOKE dans cette lettre montrait que la ligne décrite par le corps dans sa chute « would not be a spiral line, as Mr. NEWTON seemed to suppose, but an excentric elliptoid (18), supposing no resistance in the medium : but supposing a resistance, it would be an excentric ellipti-spiral, which, after many revolutions, would rest at last in the centre : that the fall of the heavy body would not be directly east, as Mr. NEWTON supposed; but to the south-east, and more to the south than the east. It was desired, that what was tryable in this experiment might be done with the first opportunity » (19). Avouons qu'en l'absence du texte de HOOKE — que nous avons vainement tenté de retrouver — il est difficile d'imaginer par quel processus l'auteur de la *Micographie* en vint à amender les premiers résultats de NEWTON. « M. HOOKE replied it would not descend to the center but at a certaine limit returne upwards againe » déclara plus tard NEWTON (20). Nous reprenons plus loin la question de rechercher dans quelle mesure et par quels moyens HOOKE a pu rectifier les erreurs du savant qu'il jalouse.

Voici enfin la réponse irritée et sèche de NEWTON. On la sent pleine d'une impatience difficilement contenue : « I could scarce persuade myself to answer his second letter » (21). Nous avons naturellement respecté l'orthographe et la ponctuation de l'original (22).

St

I agree wth you y^t y^e body in o^r latitude will fall more to y^e south then east if y^e height it falls from be any thing great [1]. And also that if its gravity be supposed uniform it will not descend in a spiral to y^e very center but circulate wth an alternat ascent & descent made by it's vis centrifuga & gravity alternately overballancing one another. Yet I imagin y^e body will not describe

(18) Probablement une courbe ovale : « an ellipsis » dit Newton (lettre à HALLEY, 20 juin 1686.

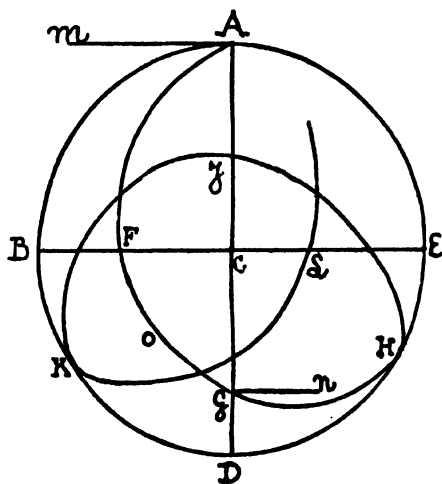
(19) BIRCH, *History of the Royal Society of London*, 1757, vol. 3, p. 516.

(20) Lettre à HALLEY, 27 mai 1686.

(21) Lettre à HALLEY, 20 juin 1686.

(22) Les chiffres entre crochets [] dans le texte renvoient aux remarques que nous faisons plus loin.

an Ellipsoeid but rather suit a figure as is represented by A F O G H J K L etc. Suppose A y^e body, C y^e center of y^e earth, A B D E quartered wth perpendicular diameters A D, B E, w^{ch} cut y^e said curve in F & G; A M y^e tangt in w^{ch} y^e body moved before it began to fall & G N a line drawn parallel to y^t tangt. When y^e body descending through y^e earth (supposed pervious) arrives at G, the determination of its motion shall not be towards N but towards y^e coast between N & D. ffor y^e motion of y^e body at G is compounded of y^e motion it had at A towards M & of all y^e innumerable converging motions successively generated by y^e impressesses of gravity in every moment of it's passage from A to G: The motion from A to M being in a parallel to G N inclines not y^e body to verge from y^e line G N. The innumerable & infinitely little motions (for I here consider motion according to y^e method of indivisibles) [2] continually generated by gravity in its passage from A to F incline it to verge from G N towards D, & y^e like motions generated in its passage from F to G incline it to verge from G N towards C. But these motions are proportional to y^e time they are generated in, & the time of passing from A to F (by reason of y^e longer journey & slower motion) is



greater then y^e time of passing from F to G. And therefore y^e motions generated in AF shall exceed those generated in F G & so make y^e body verge from G N to some coast between N & D. The nearest approach therefore of y^e body to y^e center is not at G but somewhere between G & F as at O. And indeed this

point O, according to y^e various proportions of gravity to the impetus of y^e body at A towards M, may fall any where in y^e angle B C D in a certain curve w^{ch} touches y^e line B C at C & passes thence to D [3]. Thus I conceive it would be if gravity were y^e same at all distances from y^e center. But if it be supposed greater nearer y^e center [4] y^e point O may fall in y^e line C D or in y^e angle D C E or in other angles y^t follow, or even no where. ffor the increase of gravity in y^e descent may be supposed such y^t y^e body shall by an infinite number of spiral revolutions descend continually till it cross y^e center by motion transcendently swift.

Your acute Letter having put me upon considering thus for y^e species of this curve, I might add something abouts its description by points quam proxime. But the thing being of no great moment [5] I rather be yo^r pardon for having troubled you thus far wth this second scribble wherin if you meet wth any thing inept or erroneous I hope you will pardon y^e former & y^e latter I submit & leave to yo^r correction remaining S^r

Yo^r very humble Servant

IS. NEWTON

'Trin Coll.

Dec 13th 1679 [6]

For Mr. ROBERT HOOKE

at his Lodgings in

Gresham College in London

La lettre porte aussi une inscription due, nous semble-t-il, à la main de HOOKE :

NEWTON De : 13. 1679

to HOOK of the line described by falling Bodies, wth a scheme.

[1] « I learned nothing by his letters but this, that bodies fall not only to the east, but also in our latitude to the south. In the rest his correcting and informing me was to be complain'd of. And tho' his correcting my spiral occasioned my finding the theorem, by which I afterwards examined the ellipsis; yet am I not beholden to him for any light into the business, but only

for the diversion he gave me from my other studies to think on these things, and for his dogmaticalness in writing, as if he had found the motion in the ellipsis, which inclined me to try it, after I saw by what method it was to be done » (lettre à HALLEY, 27 juillet 1686).

Il n'est peut-être pas inutile non plus de reproduire les lignes suivantes, empruntées au traité *de Motu* (troisième exemplaire de la collection Portsmouth, non postérieur probablement au printemps de 1685; ROUSE BALL, loc. cit., pp. 35 et 56) :

« Caeterum projectilium motus in aere nostro referendi sunt ad immensum et revera immobile coelorum spatium, non ad spatium mobile quod una cum terra et aere nostro convolvitur et a rusticis ut immobile spectatur. Invenienda est Ellipsis quam projectile describit in spatio illo vere immobili et inde motus ejus in spatio mobili determinandus. Hoc pacto colligitur grave, quod de aedificii sublimis vertice demittitur, inter cadendum deflectere aliquantulum a perpendiculo, ut et quanta sit illa deflexio et quam in partem. Et vicissim ex deflexione experimentis comprobata colligitur motus terrae. Cum ipse olim hanc deflexionem Clarissimo HOOKIO significarem, is experimento ter facto rem ita se habere confirmavit, deflectente semper gravi a perpendiculo versus orientem et austrum ut in latitudine nostra boreali oportuit. »

[2] L'allusion à la méthode des indivisibles ainsi que l'emploi de l'expression « the determination of its motion » méritent d'être notés : on imagine assez difficilement en effet que HOOKE n'ait pas été au courant de la méthode des fluxions; il y a peut-être lieu cependant de justifier le texte de NEWTON par les considérations suivantes.

Si l'exposé, dans cette lettre ainsi que dans la précédente (28 novembre), procède de la méthode synthétique, il est toutefois hors de doute que NEWTON obtint ses résultats par la voie analytique, qu'il utilisait dès 1670 avec la notation nouvelle (23). Dans sa deuxième lettre à LEIBNIZ (24 octobre 1676) NEWTON ne donne encore les principes de sa méthode que sous forme de crypto-

(23) *L'Analysis per Aequationes Numero Terminorum Infinitas*, qui fut communiqué à BARROW en 1669, mais n'était pas destiné à la publication, ne contient pas d'indice de la nouvelle notation de NEWTON; la méthode directe des fluxions date de novembre 1665 (cf. Memorandum de la collection Portsmouth et la lettre de NEWTON au Dr. KEILL, 15 mai 1714).

grammes (24). Pourquoi semble-t-il éviter ici l'emploi du mot *fluxion*, si imagé ? D'où vient cette réserve ? Il y a apparemment deux raisons de cela :

a) l'une est donnée par NEWTON lui-même dans de nombreux écrits. La persistance des attaques dont il était l'objet, la conscience du temps qu'il perdait à réfuter inutilement les opinions souvent peu scientifiques de ses adversaires l'avaient rendu irritable et méfiant. Plus d'une fois, il ne consentit à communiquer ses résultats qu'avec l'assurance que l'anonymat serait respecté. Ses lettres à HALLEY (1686-7) sont remplies de doléances au sujet de la nouvelle querelle provoquée par HOOKE, et les plaintes sont tout aussi vives lors de la première dispute : s'adressant à OLDENBURG : « I intend to be no farther solicitous about matters of philosophy; and therefore I hope you will not take it ill if you never find me doing any thing more in that kind; or rather that you will favour me in my determination, by preventing, so far as you can conveniently, any objections or other philosophical letters that may concern me ». A LEIBNIZ (9 décembre 1675) : « I was so persecuted with discussions arising out of my theory of light, that I blamed my own imprudence for parting with so substantial a blessing as my quiet to run after a shadow » (25).

On comprend donc pourquoi NEWTON eut le plus souvent recours à un exposé synthétique de ses découvertes, exposé qui, — étant donné l'importance prise depuis par la méthode alors toute nouvelle — nous semble archaïque à présent. Nous avons d'ailleurs trouvé récemment à Oxford un brouillon de lettre (non daté, mais postérieur à 1697) que nous espérons pouvoir bientôt publier. NEWTON y fait l'éloge de l'Analyse des Anciens, qu'il trouve plus simple et plus ingénieuse pour un Géomètre que l'Algèbre des modernes. Ce document montre nettement jusqu'à quel point l'auteur des *Principes* s'était assimilé la pensée hellénique. Cependant, en faisant usage pour l'exposé de ses résultats d'une méthode différente de celle utilisée au cours des recherches, il rendit singulièrement ardue la lecture de son œuvre. C'est ainsi

(24) LEIBNIZ possédait certainement à cette époque l'essentiel de sa méthode, mais son premier mémoire concernant la méthode infinitésimale ne parut qu'en 1684, et la période aiguë de la querelle de priorité ne devait commencer que tout à la fin du dix-septième siècle.

(25) Cf. aussi les lettres à OLDENBURG des 26 avril et 18 novembre 1676 et l'Introduction du troisième livre des *Principes*.

que LAPLACE ne fut ni le premier ni le dernier à se plaindre de l'obscurité de NEWTON.

b) Il ne faut pas perdre de vue ensuite que NEWTON, en dépit de l'importance et de l'originalité presque uniques de son œuvre mathématique, fut avant tout un physicien, et même un expérimentateur. S'il s'est laissé devancer par LEIBNIZ dans la publication de l'exposé des règles du calcul infinitésimal, c'est parce qu'il ne voulait pas séparer ces règles de leur applications : c'est là l'origine de la stérile querelle de priorité (26). Il eut surtout le désir de faire servir les mathématiques à la résolution de problèmes concrets et ne les cultiva pas pour elles-mêmes (27). Lorsqu'on tente d'envisager dans son ensemble l'œuvre de NEWTON, on a l'impression que l'invention de la méthode des fluxions n'a été qu'une diversion, nécessaire au genre de travaux auxquels le portaient naturellement ses goûts. Au surplus, si l'on totalise le temps qu'il consacra entre les années 1666 et 1686 à des travaux de mathématiques pures ou appliquées, on ne trouve guère plus de deux ans et demi, en y comprenant la période employée à la préparation des *Principes*.

Les phénomènes naturels peuvent être étudiés de différentes façons. Les mathématiques, il est vrai, permettent de transposer la réalité en un langage commode et nous aident même à prévoir des faits nouveaux; en ce sens, on peut leur reconnaître un rôle créateur, encore que la voie uniquement expérimentale puisse autoriser peut-être les mêmes prédictions; mais elles ne constituent à tout prendre qu'un intermédiaire dont

(26) A propos de la publication des *Principes*, il écrit à HALLEY le 1 mars 1687 : « I am obliged to you for pushing on the edition, because of people's expectation, tho' otherwise I could be as well satisfied to let it rest a year or two longer ».

(27) Signalons ici l'analogie frappante de l'idéal scientifique de NEWTON avec celui de ROGER BACON (que l'auteur des *Principes* n'a presque certainement jamais lu). La méthode qu'applique le moine franciscain — chez qui on retrouve la plupart des traits qui constituent l'essence même de la spiritualité anglaise, et cela bien avant que les peuples d'Angleterre aient pris conscience de leur individualité — se réduit à un empirisme coordonné par les mathématiques. Comme NEWTON, R. BACON envisage surtout les mathématiques au point de vue pratique, c'est-à-dire au point de vue de leurs applications. Il ne fit jamais le moindre effort pour démontrer un théorème. Comme NEWTON, il est bien plus physicien que mathématicien, mais, comme NEWTON aussi, il ne peut assez exalter le rôle des mathématiques dans l'étude de la nature : « Naturales mundi sciant quod languebunt in rebus naturalibus, nisi mathematicae noverunt potestatem. » Il ne serait pas difficile de multiplier les citations sur ce sujet.

le mérite essentiel est d'imposer la vérité de façon rapide et sûre.

Ainsi, NEWTON apparaît comme ayant été d'autant moins enclin à faire allusion dans sa lettre à la méthode des fluxions qu'il désirait au plus vite et définitivement se faire comprendre de HOOKE. Celui-ci d'ailleurs n'était peut-être pas au courant du nouveau procédé de calcul (28) ; il reste dès lors à se demander comment il obtint — en apparence du moins — certains résultats (29). Nous reproduisons ici une opinion de NEWTON qui contribuera sans doute à la solution de ce problème si intéressant : « He has done nothing, and yet written in such a way, as if he knew and had sufficiently hinted all but what remained to be determined by the drudgery of calculations and observations, excusing himself from that labour by reason of his other business, whereas he should rather have excused himself by reason of his inability. For 'tis plain, by his words, he knew not how to go about it. Now is not this very fine? Mathematicians, that find out, settle, and do all the business, must content themselves with being nothing but dry calculators and drudges; and another, that does nothing but pretend and grasp at all things, must carry away all the invention, as well of those that were to follow him, as of those that went before ». (30) Il est certain que HOOKE n'a pas toujours su franchir la distance énorme qui sépare les intuitions heureuses des démonstrations certaines. HOOKE était un génie d'une très grande profondeur et c'est un des savants qui honorent le plus l'Angleterre. Mais, il eut le tort de se satisfaire trop vite de conjectures qu'il ne prenait pas la peine de contrôler par le calcul (31).

(28) « I doubt not that by your excellent method you will easily find out what that curve must be, and its propriety... » (lettre de HOOKE à NEWTON, 17 janvier 1680).

(29) Cf. ci-dessous au n° [3].

(30) Lettre à HALLEY, 20 juin 1686.

(31) Il convient de noter ici que la *Micrographie* et les *Lectiones Cutlerianae* ne contiennent à vrai dire pas une ligne de calculs. Un exemple frappant de la manière habituelle de HOOKE nous est fourni par le seul passage connu de sa lettre du 9 décembre 1679 : « I could add many other considerations consonant to my theory of circular motions compounded by a direct motion and an attractive one to the center... » De même, le 6 janvier 1680, il écrit : « ...in the celestial motions the sun, earth, or centrall body are the cause of the attraction, and though they cannot be supposed mathematicall points yet they may be conceived as physicall, and the attraction at a considerable distance may be computed according to the former proportion as from the very center ». NEWTON aussi possédait intuitivement le théorème d'après lequel, pour étudier l'attraction exercée par

[3] Voici les principaux résultats auxquels on est conduit dans l'étude de la trajectoire d'un point matériel soumis à une attraction centrale constante, la vitesse initiale étant perpendiculaire au rayon vecteur passant par la position initiale (32). « I then took the simplest case for computation, which was that of gravity uniform in a medium not resisting—imagining he had learned the limit from some computation, and for that end had considered the simplest case first. And in this case I granted what he contended for, and stated the limit as nearly as I could » (lettre à HALLEY, 27 mai 1686).

La trajectoire du mobile pour une vitesse initiale donnée est composée d'arcs égaux dont chacun est vu du centre sous un angle constant

$$\alpha = \int_{\pi}^{+\frac{\pi}{2}} \frac{1 + \lambda \sin \phi}{3 + \lambda \sin \phi} \delta \phi \quad (1)$$

avec

$$\lambda = \frac{R - \rho}{R + \rho} \quad (2)$$

R étant le vecteur initial supposé égal au rayon terrestre et ρ la valeur minimum du rayon vecteur, cette valeur étant la racine positive de l'équation

$$\rho + R - 2 K \rho^2 R^2 = 0 \quad (3)$$

où $K = \frac{j}{v_0^2 R^2}$; la trajectoire ne sera à l'intérieur de la terre

que si $K > \frac{1}{R^3}$ ou $v_0 < \sqrt{jR}$; elle ne sera pas une courbe fermée,

l'angle α étant incommensurable avec π .

« Your calculation of the curve described by a body attracted

une planète, on peut supposer ce corps réduit à un point matériel de même masse coïncidant avec son centre; mais ce n'est qu'en 1685 qu'il en trouvera la démonstration. HOOKE, se basant sur sa lettre de 1680, ne manque pas de revendiquer pour lui-même la découverte du théorème.

(32) Si l'on ne fait pas l'hypothèse que la terre se réduit à un point matériel de même masse coïncidant avec son centre, on est ramené au problème de la détermination du mouvement des météores dans un essaim sphérique ou d'une étoile dans un amas globulaire, mais la résolution de cette question implique une hypothèse sur la relation qui donne la densité en fonction de la distance au centre. Cf. P. TEN BRUGGENCATE, Sternhaufen, Berlin, SPRINGER, 1927.

by an aequall power at all distances from the center, such as that of a ball rolling in a inverted concave cone, is right, and the two auges will not unite by about a third of a revolution » (33). HOOKE a donc observé qu'on peut ramener au problème traité par NEWTON l'étude du mouvement d'un point pesant assujéti à se mouvoir sur un cône de révolution, d'axe vertical et de rayon CA, reposant sur la pointe en C. On sait que cette équivalence des deux problèmes est une conséquence des équations intrinsèques du mouvement du point sur la surface conique. Si l'on songe que HOOKE ne s'est probablement livré à aucun calcul, sa remarque donne une mesure exacte de la profondeur et de la sûreté de son intuition. On peut noter aussi l'analogie de la courbe dessinée par NEWTON avec la projection de la trajectoire obtenue dans l'étude du problème du pendule sphérique, dans le cas où les deux parallèles extrêmes sont dans l'hémisphère inférieur.

Le lieu du point O est une courbe définie en coordonnées polaires $[(C, CA), \rho, a]$ par les équations (1), (2) et (3); cette courbe est tangente à BC en C et passe par le point $(\rho = R, a = \frac{\pi}{\sqrt{3}})$ correspondant à $\lambda = 0$; ceci ne concorde donc pas avec le résultat de NEWTON : « a certain curve w^{ch} touches y^e line BC at C & passes thence to D ». Il n'est d'ailleurs pas aisé de définir avec précision les propriétés du lieu O, puisqu'on se heurte à une intégrale elliptique. Cette difficulté n'a vraisemblablement pas dû surprendre NEWTON, habitué à pareille rencontre, et il a pu trouver une construction approchée, soit en discutant l'équation différentielle sans l'intégrer, soit en l'intégrant d'une manière approchée.

[4] Quant au cas de la gravité variable (34), supposons que celle-ci soit une fonction arbitraire de la distance au centre attirant. J. BERTRAND a recherché quelle devait être cette fonction pour que la trajectoire fût fermée : « ...deux lois seulement remplissent

(33) Réponse de HOOKE à NEWTON, 6 janvier 1680.

(34) « He replied that gravity was not uniform but increased in descent to the center in a reciprocally duplicate proportion of the distance from it, and thus the limit would be otherwise than I had stated it, namely, at the end of every intire revolution, and added that according to this duplicate proportion the motions of the planets might be explained and their orbs defined » (lettre à HALLEY, 27 mai 1686).

les conditions demandées, celle de la nature (35), pour laquelle l'orbite fermée n'a qu'un axe de symétrie passant par le centre d'action, et l'attraction proportionnelle à la distance, pour laquelle il y en a deux » (36), ceci dans le cas où la vitesse initiale ne dépasse pas une certaine limite. « Les orbites planétaires sont des courbes fermées; c'est la cause principale de la stabilité de notre système, et cette circonstance importante résulte de la loi d'attraction qui, quelles que soient les circonstances initiales, fait mouvoir chaque corps céleste qui n'est pas expulsé de notre système, suivant la circonférence d'une ellipse. On n'a pas remarqué jusqu'ici que la loi d'attraction newtonienne est la seule qui remplisse cette condition.

Parmi les lois d'attraction qui supposent l'action nulle à une distance infinie, celle de la nature est la seule pour laquelle un mobile lancé *arbitrairement* avec une vitesse inférieure à une certaine limite, et attiré vers un centre fixe, décrive nécessairement autour de ce centre une courbe fermée. Toutes les lois d'attraction *permettent* des orbites fermées, mais la loi de la nature est la seule qui les impose ». (37)

En comparant ces divers résultats avec les trajectoires planétaires et la lenteur du déplacement des périhélics, NEWTON a donc dû se trouver en possession d'une indication précieuse sur la loi d'attraction, dont il entrevoyait l'exactitude à cette époque, mais dont cependant il ne possédait pas encore de démonstration certaine. Le document inédit qu'on a lu plus haut où — il importe de le remarquer — la loi de variation de la gravité en fonction de la distance au centre n'est pas énoncée (38), confirme donc la thèse récemment développée par Mr. CAJORI dans un article

(35) « ... with such an attraction the auges will unite in the same part of the circle, and the nearest point of the accesse to the center will be opposite to the furthest distant, which I conceive doth very intelligibly and truly make out all the appearances of the heavens ». (Réponse de HOOKE à NEWTON, 6 janvier 1680).

(36) J. BERTRAND, *C. R. Ac. des Sc.* de Paris, séance du 20 octobre 1873.

(37) *id.*

(38) Il n'est fait non plus aucune mention explicite de cette loi dans la lettre « For Mr. CROMPTON to be sent to Mr. FLAMSTEAD » (Cambridge, 28 Fev. 1681) : « ... I can easily allow an attractive power in the sun, whereby the planets are kept in their curves about him from going away in tangent lines... » L'énoncé de la loi n'apparaît pas davantage dans un projet de réponse à FLAMSTEAD (16 avril 1681).

remarquable (39) : si NEWTON a retardé pendant près de vingt années la publication de la loi d'attraction, c'est parce qu'il la croyait une simple approximation : « Before 1685, NEWTON suspected that the law of inverse square was a mere approximation to the truth ». *Contrairement à l'opinion courante, l'exactitude de la valeur du rayon terrestre n'eut rien à voir avec la question* (40). [5] « ...And therefore (though in truth I agree with you that the explicating the curve in which a body descending to the center of the earth would circumgyrate were a speculation of noe use yet) the finding out the propriety of a curve made by two such principles will be of great concerne to mankind because the invention of the longitude by the heavens is a necessary consequence of it,

(39) *Sir Isaac Newton 1727-1927, A bicentenary Evaluation of his work*, London, BAILLIÈRE, TINDALL and COX, 1928 (*Isis*, 11, 387-93) ; cf. p. 127 : NEWTON's twenty years delay in announcing the law of gravitation, by FLORIAN CAJORI.

(40) Les idées de Mr. CAJORI nous paraissent si intéressantes que nous ne pouvons nous empêcher de reproduire ici à leur appui deux passages d'une lettre peu connue de NEWTON à FLAMSTEAD. Cette lettre n'est pas datée, mais fut écrite, selon FLAMSTEAD, en 1685 ou en janvier 1685-6 :

« ...I have not at all minded Astronomy of some years till on this occasion, which makes me more to seek... Now I am upon this subject, I would gladly know the bottom of it before I publish my papers.

...Your information about the error of KEPLER's table for Jupiter and Saturn has eased me of several scruples. I was apt to suspect there might be some cause or other unknown to me, which might disturb the sesquialtera proportion, for the influences of the planets one upon another seemed not great enough, tho' I imagined Jupiter's influence greater than your numbers determine it. It would add to my satisfaction, if you would be pleased to let me know the long diameters of the orbits of Jupiter and Saturn assigned by yourself and Mr. HALLEY in your new tables, that I may see how the sesquialtera proportion fills the heavens together with another small proportion, which must be allowed for ». (*A General Dictionary, Historical and Critical, 1734-1741*, (BAYLE) by BERNARD, BIRCH, LOCKMAN ; vol. 7). Notons aussi les lignes suivantes dans le traité *de Motu* (troisième exemplaire de la collection Portsmouth, voir plus haut) : « Demonstratis igitur legibus reguntur motus in cælis. Sed in aere nostro, si resistentia ejus non consideratur, innotescunt motus projectilium per Prob. 4 et motus gravium perpendiculariter cadentium per Prob. 5 posito nimirum quod gravitas sit reciproce proportionalis quadrato distantiae a centro terrae. Nam virium centripetarum species una est gravitas; et computanti mihi prodiit vis centripeta qua luna nostra detinetur in motu suo menstruo circa terram ad vim gravitatis [his] in superficie terrae reciproce ut quadrata distantiarum a centro terrae quam proxime. Ex horologii oscillatorii motu tardiore in cacumine montis praealti quam in valle liquet etiam gravitatem ex aucta nostra a terrae centro distantia diminui, sed qua proportionem nondum observatum est. »

for the composition of two such motions I conceive will make out that of the moon ». (41)

[6] Le journal de HOOKE ne porte aucune indication à la date des 14, 15 et 16 décembre. Mais la lettre de NEWTON parvint à son destinataire, qui y répondit le 6 janvier 1680 :

Sun 4... — perfect theor. of Heavens —

Tues 6... Sent Letter to Mr. NEWTON.



Nous nous proposons de revenir bientôt sur plusieurs questions intéressantes soulevées par la lettre publiée ici, notamment sur la contribution qu'elle apporte à l'histoire de la genèse des *Principes*.

Nous publierons prochainement d'autres inédits de NEWTON. Le présent travail a pu être achevé grâce à l'intervention du Fonds national belge de la Recherche scientifique.

Bruxelles.

JEAN PELSENEER.

(41) Réponse de HOOKE à NEWTON, 6 janvier.

La Peste de 1763 en Dalmatie.

III. Appendice.

PIÈCES JUSTIFICATIVES. — NOTES.

Terminazione in materia di sanità per il contaggio sviluppatosi ne'Borghi di Spalato.

NOI PIETRO MICHIEL etc.

Alle caute disposizioni estese dal zelo di questo Illustrissimo Conte e Capitano Dolfin, unitamente al Spettabile Colleggetto di Sanità sopra la fatale insorgenza del morbo pestilenziale reso manifesto in questo Borgo Grande nel dì 19 X.bre. prossimo scaduto, e diramatosi in appresso negl'altri, abbiamo data mano sollecita colla nostra comparsa sul luogo, ed aggiunte tutte quell'altre providenze, che relative alle Leggi del Maggistrato Eccellentissimo Supremo Presside nella materia, ed utilmente poste in pratica altre uolte, specialmente nell'anno 1731 uagliano con l'ajuto Diuino a spegnere l'orribile fiamma, che con giornaliera luttuosissime conseguenze diuampa trà queste infelici popolazioni.

Già disposta, ed armata la Linea di circonuallazione di detti Borghi con le diuisorie l'uno dall'altro, separate, e barricate le Case infette, stabiliti li Ospitali, li Lazzaretti per gl'infermi, per li sospetti, per li conualescenti, e per gli espurghi, non che li Cimiterj in opportune situazioni per li sotterramenti, restarono parimenti destinati con addattate commissioni li necessarj Sopraintendenti, e Deputati, con Medici, e Chirurghi, e l'altre persone tutte, che nelle rispettiue mansioni contribuir deuono l'opera loro.

Mà perchè da ciascheduno si abbia una sicura norma di direzione nelle peculiari sue incombenze, e delli modi con li quali dourà essere trattata questa gelosissima materia, ritrouiamo conferente di dichiarare, e comprendere nella presente Nostra Terminazione in separati, e distinti articoli li ordini, e le regole da osservarsi in risserua di aggiungere successiuamente quell'altre prescrizioni,

e providenze, che si rendessero egualmente necessarie, e che fossero per deriuarci dall'ossequiata Auttorità del sopradetto Eccellentissimo Magistrato nell'importanza dell'argomento.

Inuocandosi però da Noi la misericordia dell'Onnipotente dalla quale principalmente si ha da confidare, e da riconoscere la sospirata calma, e liberazione dai mali presenti, ordiniamo, e terminiamo quanto segue :

Primo.

Qualunque persona di qualsiuoglia condizione, e grado, a riserva di quelle destinate in alcuna incombenza per le presenti emergenze non ardisca in qualsisia tempo sortire dai Recinti di questa Città per condursi in altri Luoghi, senza la partecipazione della Carica, sotto le più seure pene, ed anco della uita, à misura della trasgressione.

2^{do}.

Se alcuno per sua fatalità si sentisse attaccato dal Morbo, dourà testo manifestarsi al Deputato cui spetta, ed anco a cognizione di tutti, sicchè prendersi immediate le misure già prescritte nel proposito, senza differirne l'importante notizia allorchè fosse agl'estremi, poichè uenendo scoperto in altro modo, sarà irremissibilmente punito nella uita, prima che soccomba alla uiolenza del male, alla qual pena s'intenderanno parimenti incorsi li Congiunti, e qualunque altro concoresse a tenere occulta la persona colpita.

3^o.

Anco quelli, che si trouassero sorpresi da mali di altro genere saranno egualmente nell'obbligo di manifestarlo al Deputato sudetto, per quelle osseruazioni, e uerificazioni, che incombono alli destinati Medico, e Chirurgo, e ciò sotto le più seure pene, ed anche della uita.

4^{to}.

Resta assolutamente proibita qualunque radunanza, e concorso, ed in particolare li funebri, tuttoche per causa di morti prodotte da mali non sospetti, sotto le pene più rigorose a quelli che u'interuenissero, e ui prestassero assenso.

5^{to}.

Si eccitano bensì li Religiosi, Chierici, e Regolari, affinchè non manchino li spirituali suffraggi alli poueri infetti, ed alli sospetti, di concorrere con la loro caritateuole assistenza, sempre però trà le douute risserue ad amministrare ad essi li S. S. Sacramenti, animandoli, e confortandoli nelle loro calamitose circostanze.

6^{to}.

Chiunque auuesse, o ritenesse appresso di se robbe, ed effetti di qualunque genere delle Case, e famiglie infette, o che le tenesse occulte, e sepolte, dourà sotto pena della uita palesarle a questa Carica, o alle persone deputate di Sanità, promettendo a' medesimi, che le dette robbe, ed effetti non saranno incendiati, ma conseruati per il competente espurgo, indi riconsegnate a' Proprietarj.

7^{mo}.

Così quelli, che fossero in cognizione d'attrouarsi robbe, ed effetti come sopra nascosti, douranno egualmente reccarne gl'auuisi, in pena pure della uita.

8^o.

Per rimouere le perniciosissime conseguenze, che deriuar possono nelle congiunture presenti dal uagar di Cani, e Gatti, douranno e gl'uni, e gl'altri assolutamente essere uccisi, al qual effetto s'incaricano espressamente gl'Uffiziali Ispettori, li Deputati rispettiui, ed ogni altra Pubblica persona, che s'attroua ne Borghi.

9^o.

Già interdetta la comunicazione trà li luoghi infetti, ed altresì dei Territoriali co' Borghi medesimi, resta ingionto l'uso della maggior uigilanza al Soprintendente alla Linea, ed alli Subordinati Capiposti, e Direttori sopra l'armo della medesima per la sua più esatta custodia, frequentando perciò le uisite, e le ronde specialmente di notte, onde mantenere nel puntuale esercizio dei loro doueri le Guardie, le quali auranno da far fuoco addosso a qualunque tentasse uiolare le frapposte segregazioni, coll'uscire dalli Recinti delle Linee, o penetrare clandestinamente in esse.

10^{mo}.

Tutti gli abitanti presentemente ne Borghi douranno trattenersi nel Recinto delle loro Case finchè siano consumate le Visite delle persone Deputate, nelli tempi, e modi qui sotto espressi, e qualunque si ritrouasse fuori della propria abitazione prima della uisita stessa, massime in tempo di notte, incorrerà irremissibilmente nella pena della uita.

II.

Inuigilaranno per tal conto li accennati Direttori della Linea, e le Guardie esterne, ed interne, non meno che per impedire, onde non siano commessi furti, arerstando cautamente li Ladri, che colti col furto, saranno considerati rei di morte, e se facessero resistenza, o uiolenza per fuggire, sarà loro fatto fuoco addosso.

OBBLIGHI DEI DEPUTATI, MEDICI, CHIRURGHI, ED ALTRI.

Primo.

Incomberà precisamente alli Deputati, o siano Capi di Contrada destinati nei rispettiui Borghi, fatti diuidere in Sestieri, di trasferirsi in cadauna mattina, doppo il leuar del Sole unitamente all'assegnato Chirurgo, e coll'assistenza degl'occorrenti Guardiani alla uisita oculare con li douuti riguardi di tutte le Famiglie, e Case raccomandate alla loro ispezione, rileuare accuratamente lo stato di salute delle persone di cadauna Famiglia, rincontrandone di Casa in Casa il numero col Piedilista dell'anime appresso di loro esistente, e descriuere poi in Note distinte, da essi firmate, ed egualmente dal Chirurgo, ogni accidente, che uenisse loro di risultare per auuanzarle immediate al Colonello Sopraintendente Mazzuccato, che ha l'incombenza di riceuerle, e di riportare alla Carica ogni insorgenza, ed assieme un'esatto giornaliero Piedilista.

2^{do}.

Ritrouandosi, o scoprendosi dalli Deputati sudetti qualche persona inferma in alcuna delle Case uisitate, dourà tosto colle neccesarie cautele essere diligentemente esaminata dal Chirurgo, e quallora la qualificasse coll'opinione del Medico deputato colpita

dal morbo pestilenziale, aurà tosto nelli cauti modi già preffissi da farsi passare agl'Ospitali destinati ad uso degl'infetti, e li restanti della Famiglia negl'altri luoghi, o siano Lazzaretti riseruati per li sospetti, li quali douranno collocarsi possibilmente diuisi l'uno dall'altro, e procedersi indi alli neccessarj espurghi, preuio il cambiamento de loro uestiti, con l'immersione de corpi nudi in Mare, se la Stagione lo comportasse ouero con l'abluzione di acetto, ed assieme col profumo antipestilenziale. Dourà auuertirsi tosto sgombrata la Casa degl'abitanti di far ben chiudere, ed assicurare tutte le Finestre, Fori, e Porte, barricarui gli accessi, apponerui le neccessarie fedeli custodie, e contradistinguere la Casa stessa con la marca di un segno osseruabile.

3^o.

Lo stesso metodo dourà egualmente osseruarsi per quelle Case, nelle quali si trouasse alcun estinto con segni, o indizij del fatal morbo, de quali accidenti come sopra raguagliato il Colonello Sopra-intendente si farà tradurre il Cadauere dai destinati Beccamorti premuniti dei soliti uestimenti, e d'istrumenti nelli modi preffissi alli Cimiterj stabiliti, doue sotterrarsi nudo il Cadauere stesso alla presenza del Deputato alli sotterramenti in Fossone formato nelle fissate profondità, per ricoprirsi con Calcina uiua, et indi con terra copiosa, finchè il piano resti uguagliato alla superficie.

4^{to}.

Dourà procedersi in conformità dal Deputato, e Chirurgo destinati alle respetiue ispezioni delli Lazzaretti delli sospetti nel Castello Capogrosso, e nell'altro di San Steffano all'occasione delle loro uisite giornaliere, tanto in rapporto a quelle persone, che si scoprissero infette, come per gli altri, che mancassero di uita.

5^{to}.

Coll'incontro dell'accennate quotidiane uisite auranno anco da somministrarsi ad ogni uno i neccessarj alimenti, a misura della costituzione nella quale s'attrouassero giusta le commissioni già rilasciate nel proposito al predetto Colonello, et alli Deputati per tal conto, e prestarsi loro quegl'altri souuegni, che si rendessero indispensabili, e particolarmente di Medicinali, proffumi, accetti, Vini, et altro.

6^{to}.

Superandosi dagl'infetti la malignità del morbo, trascorsa che sia la prima quarantena, si faranno passare nell'altro luogo scielto come Lazzaretto dei Conualescenti, preuie le già descritte diligenze dell'immersione de Corpi nudi in Mare, ouero delle abluzioni con acetto, e de proffumi, con la mutazione de loro uestiti.

7^{mo}.

Anche in questo secondo Lazzaretto saranno quotidianamente uisitati dalli Deputati, e Chirurghi per riconoscere se nel corso della quarantena seconda si manifestasse in alcuna contumazia qualche segno d'infezione per far ritornare immediate il colpito sotto la classe degl'infetti con la nuoua segregazione delle persone, che seco lui s'attrouassero, e con li metodi, ed auuertenze di sopra dichiarite.

8^o.

Ma consumata la seconda quarantena senza nouità, passeranno nel terzo luogo ad uso di rispetto, douc saranno trattenute le persone, che licenziate fossero dalla contumacia de sospetti, parimenti questo terzo luogo caderà sotto l'ispezione del Deputatto ed alle neccessarie giornaliere Visite, custodito come gli altri da Guardie, e regolato nei modi, e per quel periodo di tempo, che opportunamente saremo per addittare.

METODO PER GL'ESPURGHİ DELLE MOBILIE INFETTE,
E SOSPETTE.

Primo.

Sgombrata dagl'abitanti tutti la Casa infetta nelli modi già sopra dichiariti dourà coll'interuento del Deputato a tal ispezione asportarsi, e condursi dalli destinati Bastazzi ogni mobilia col mezzo di Casse, di Ceste, o di Sacchi incatramati al luogo stabilito per il loro espurgo, doue assoggetarsi imediate le robbe di Lana, e simili all'immersione nell'acqua di mare per più giorni, e quallora fossero euidentemente infette, o molto sucide auranno da soggiacere al tormento del Lissiuo, o sia acqua bollente con cenere per un'ora, a misura della prudenza di chi dirige.

2^{do}.

Le robbe di setta, ed altresì li pellami si esponderanno sopra le Corde preparate allo Sborro, ed auranno a trattarsi con proffumi forti, indi ben maneggiarsi, e uentilarsi, scuotendole con Bastoni, e tutto ciò per più, e meno di tempo, secondo il maggiore, o minore sospetto, dalli destinati Bastazzi, considerato però sempre, come tratto più breue il periodo di giorni quaranta da osseruarsi in tale occasione.

3^o.

Le Carte scritte, piture in carta, e simili aueranno ad essere diligentemente proffumate, ed abbrucciati li filli, e spaghi, che ui fossero attaccati, auertendo, che le piture in Tella doueranno inoltre essere esposte all'aria, e uentilate come sopra.

4^{to}.

Li Tamici si laueranno con acetto, e dourà attuffarsi nel Lissiuo bollente tutto ciò, che di terra, o di altro fosse formato, come Vasi, Zappe, e cose simili.

5^{to}.

Le Case, Tauole, Banchi, Scanzie, Armari, e consimili douranno lauarsi, e rilauarsi con acqua bollente, indi lasciarsi esposte all'aria, per qualche tratto di tempo.

6^{to}.

Li fodri di Palosso, le Patrone, e cose simili saranno poste pure nell'acetto, come altresì li Coltelli, Britole, ori; et argenti, manichi d'osso, e d'auorio saranno immersi nell'Acqua, o nell'acetto, secondo il maggior, o minor sospetto.

7^{mo}.

Incomberà alli Deputati Ispettori agli accennati espurghi d'assicurarsi con la cauta locale, e continua loro presenza, che non solo si eseguiscono le broue, immersioni, proffumi, e sborri, mà che a tutto rigore facciano li Bastazzi il diligentissimo quotidiano maneggio, da cui dipende la proua concludente dell'espurgo.

8º.

Stabiliti li Bastazzi di due sorti, li primi sporchi auranno da riceuere, trasportare, ed applicare alla bollitura le robbe infette, e sospette, e li secondi netti saranno per consumare li prescritti espurghi nel luogo all'effetto destinato.

9º.

Per solleuare poi in parte li Deputati all'impegno di descriuere le robbe da espurgarsi, e perchè non succedano confusioni, e smarimenti delle medesime ui si aggiungerà l'interuento de rispettiui Parochi, o di altri Sacerdoti di nota probità per formarsi le note, ed Inuentario esatto degl'effetti di cadauna Famiglia, facendo quelli marcare in modo, che non si confondano, ma che integralmente siano trasportati nel sito dell'espurgo.

10.

Dell'accennato Iuentario firmato giuratamente dal Parroco, e dagl'altri Ispettori dourà consegnarsi una copia a quest'Ufficio di Sanità, e l'originale essere custodito nella Cancellaria dell'Illustrissimo Rappresentante, a fondamento delle ragioni, che rispettiuamente competissero.

11.

Seguito il formale espurgo delle robbe sudette, saranno esse traddotte nell'altre Case affatto libere, destinate a tale occorrenza.

12.

Già stabilite apparte le regole da osseruarsi per l'admissione ed espurgo de uiueri, e comestibili prouenienti da Luoghi infetti, e sospetti, niente per ora ci resta d'aggiungere in questo proposito.

REGOLE PER L'ESPURGO DELLE COSE INFETTE.

Primo.

Le Case fabricate di Muro in Calcina, e coperte di Coppi, precesso già sempre il trasporto di tutte le robbe, douranno lasciarsi aperte intieramente al libero passaggio dell'aria, et indi incominciarsi gli espurghi con li proffumi, al qual effetto la mattina

per tempo col mezzo dei Beccamorti, e degl'altri seruenti sporchi sarà introdotto un forte proffumo fatto col Solfo, assa fettida, Corni di becco raspati, e minutamente tagliati, poluere da schioppo Catrame, e simili sopra brace accese, entro di una, o più Pignatte di Terra cotta a proporzione de luoghi spaziosi, o diuisi in più Stanze, e ben chiusi li Balconi, e le Porte, ue lo lasciaranno per uentiquattro ore.

2^{do}.

La mattina del giorno uenturo un'ora doppo leuato il Sole si aprirà tutta la Casa, e lasciatala mutar d'aria, ui entreranno li Proffumatori, tenendo in mano mazze di Frasche accese, e fumanti di ginepro, Osmarino, ed altre piante odoriffere, e girando con esse per ogni angolo, ripassaranno con le medesime ardenti le Mura, e li Soffitti, ricercando minutamente ogni parte, e ripostiglio per snidare, et abbruciare le Telle di Ragno, ed ogni altra cosa, ed immondicia non meno facile a riceuere, che a conseruare la contaggiosa infezione, loche escguito, si spazzarà diligentemente da per tutto, e nella sera si repplicaranno dello stesso modo i sopradetti forti proffumi.

3^o.

Nel susseguente giorno con acqua di Mare dourà farsi una generale lauanda de Muri, soffitti, ed anco de pauimenti, e Solari, raschiandoli, e stropizziandoli ben bene, ed insinuando di tal acqua in ogni picciola apertura di Muro di Tauola, o di altro Legname.

4^{to}.

Per due giorni auuenire si farà stare aperta la Casa, spazzandola con diligenza uerso la sera all'occasione di soliti proffumi, e nelli successiui due giorni si lauaranno e Muri, e Soffitti con acchetto forte, ed in mancanza di questo si adoprerà l'acqua in cui sia stata estinta Calcina uiua.

5^{to}.

Si lasciaranno passare altri due giorni, nei quali però si repplicarà la diligente spazzatura della Casa, ed il proffumo come sopra, et indi si passerà alla terza generale lauanda con la sudetta acqua

di Calcina, preuia però l'imboccatura, e l'incarto con calcina doue occorresse.

6^{to}.

Non potrà in appresso più introdursi la Gente sporca, e si lasciaranno spalancate le porte, e Balconi di giorno, e di notte, attendendo il beneficio di un gagliardo uento boreale, doppo di che da Gente netta si daranno a tutta la Casa due, o tre mani d'acqua di Calcina, ed in seguito ui si metteranno per più giorni repplicati proffumi dolci di foglie, e bacche di ginepro, Osmarino, Saluia, Lauanda, Surpillo, Timo, Incenso, e cose simili. Ciò compito si lascerà la Casa aperta al libero passaggio dell'aria, sinchè ritornino li Proprietarj ad abitarla.

7^{mo}.

Le Case fabricate di Muro a secco, se imboccate, o incartate in Calcina, saranno espurgate in conformità delle sopradette di Muro in Calcina, incartandole però di nuouo al di dentro, e ricercando pur minutamente al di fuori ogni bucco, e fissura accioche non ui resti della robba sospetta. Se poi non fossero nemmeno imboccate douranno disfarsi totalmente, riponendo, e sassi, e pianche in situazione, ed in modo, che possano sempre essere leuate, e spurgate dalla pioggia, e dall'aria, raccogliendosi poscia per abbrucciarsi li rimasugli unciosi, e poluerosi, che s'attrouassero nella Masiera.

8^o.

Il Legname uecchio, e tarlato dourà parimenti incendiarsi : il nuouo e non pregiudicato si lauarà repplicatamente, e quello che non fosse appianato conuerà in prima passarlo, e ripassarlo da ogni lato sopra la uampa del fuoco per abbruciarne quella pelluria, e sfilazze, che potrebbero contenere in se l'infezione.

9^o.

Trouandosi alcuna di tali Case con qualche esteriore parete, o facciata di Falasco, consumati che siano li prescritti proffumi, e la seconda lauanda, dourà lauarsi cautamente il detto parete, o sia facciata, e darsi alle fiamme il falasco, esaminandosi accuratamente le pianche del Tetto, in cui potrebbero lasciarsi doppo l'ad-

dittato diligente esame, soltanto quelle, che formano la gronda nella facciata medesima.

10.

Se gl'indicati Tetti coperti di pianche fossero bassi in modo, che somministrar potessero facilità a nasconderui robbe dentro le pianche medesime, auranno intieramente da disfarsi per riponersi le dette pianche con le uauertenze sopraccennate in luogo appartato.

11.

Le Case formate di Falasco, o siano Capanne douranno essere incendiate, a risserua dei soli palli, che le sostengono, semprechè questi meritassero l'espurgo prescritto per il legname nuouo e non pregiudicato.

12.

Nelle Case semplicemente sospette si praticaranno le abluzioni, li proffumi, e l'imbianchimento con calcina.

13.

Si farà particolar studio, ed impegno de Deputati agl'accennati espurghi, perchè sia estesa una diligentissima ricerca all'intorno delle Case, negli Orti, Cortilli, ed in ogni angolo, facendoui leuare tutte le straccie per incendiarle, e ritrouandoui robbe abbandonate, o nascoste, che fossero di qualche rilieuo, douranno mandarsi all'espurgo come infette.

14.

Per facilitare le scoperte delle robbe nascoste, si eccitano anco li Sacerdotti d'insinuare alle Famiglie superstiti a suellare, et indicare li nascondigli, con la sicurezza, che preuio il caritateuole, e diligente espurgo, e maneggio, saranno tutte le robbe restituite alli Proprietarj, o loro legittimi Eredi.

15.

Negl'Orti, nelli Cortilli, o in altri Luoghi doue la Terra fosse rugosa, o coperta di Erba, auerà la medesima da rouesciarsi,

perchè nel caso fuggisse dall'osservazione qualche rimasuglio di robbia infetta, resti coperto dalla Terra, e marcisca l'umido di essa; ladoue poi il Terreno fosse nudo, arrido, e piano, oppure celciato, sarà fatto spacciare diligentemente, e darsi alle fiamme le spazzature.

16.

Per maggior cautela si spargeranno le strade, e le superficie infette, di paglia, o brusca, sicchè dandogli fuoco uenga d'incenersi il residuo, che ui fosse d'ogni contagiosa semente.

17.

Gli altri incendj delle Strazze, e Spazzature avranno sempre da eseguirsi in Campagna aperta, e nella possibile maggior distanza dalle Case con fuoco gagliardo, fermandosi sopraunto gli esecutori.

18.

Tanto li Deputati Ispettori all'impegno delli sopradescritti espurghi, quanto li Seruenti destinati, douranno procedere con le maggiore circospezioni, e diligenze nel pontuale, e più esatto adempimento degli espurghi medesimi, poichè ommessa, o trascurata ogni benchè minima circostanza riprodur potrebbe nuoue funestissime conseguenze.

19.

Li Beccamorti douranno essere trattennuti, e custoditi nelli luoghi appartati per essi espressamenti disposti, onde non abbiano liberta di uagare, ed al caso d'impiegarli nelle loro funzioni, doueranno essere scortati da un Guardiano, e custoditi da Guardie armate in competente distanza, accordandosegli un Magazzino ben chiuso, doue riponere le loro robbe, per essere anco queste in appresso assoggettate alli necessarij rigorosi espurghi.

Per le sopradette ispezioni dourà farsi peculiare la cooperazione di questo Spettabile Colleggetto di Sanità assistito dal zelo del N. H. Rappresentante, e li rispettiui Deputati, dal Colleggetto stesso prescielti nelle uarie mansioni sotto la responsabilità della propria uita avranno personalmente d'agire, accorrere, ed inuigilare per l'osservanza più scrupolosa delli riguardi della materia nelle rispettiue incombenze loro commesse, non che per diuertire

le abusive, e disordinate confidenze di chiunque, e massime de Seruenti in uiolazione delle salutari ordinazioni. Ed affinchè in ogni tempo sia rileuata la uerità, e riconosciuta la contumacia di quelli, che trasgredito auessero in alcuna benchè minima parte le ordinazioni medesime, le quali tendono non meno all'essenzialissimo oggetto della commune presseruazione, che a solleuare gli afflitti, ed a conseruare agl'infelici superstiti le loro sostanze, restarà aperto Processo d'Inquisizione per uenir in chiaro delle delinquenze, e dei delinquenti, onde abbiano irremissibilmente soggiacere al uigor delle Leggi.

La presente intanto dourà essere auuanzata in copia al sudetto N.H. Pubblico Rappresentante, e Colleggetto per l'immediata sua pubblicazione nella Città, e ne Borghi in quella parte, che si rende neccessaria all'intelligenza uniuersale, e per recarla a lume delle particolari persone Deputate dal Colleggetto stesso giusto le Nostre ordinazioni nelle respettue mansioni, per l'adempimento degl'obblighi e metodi ingionti. Saranno parimenti accompagnati gli esemplari alli due Sopraintendenti Colonello Mazzuccato, e Tenente Colonello Rado, a necessario loro lume. In quorum fidem etc.

Dato in Spalato li 12 Gennaro 1763 M. V.

(Atti del Provveditore Generale Pietro Michiel 1763-1765, Libro I, Carte 110-116.)



NOI PIETRO MICHIEL etc.

Mentre siamo applicati con il maggior feruore, e con ogni più attento studio all'importantissimo premuroso oggetto di togliere i progressi al Contaggiioso pestilenziale Morbo, che arde, e serpeggia in questi Borghi, e massime nel Grande, con fatali luttuose conseguenze, doppo aver già fissate con la Terminazione Nostra de di 12. del corrente quelle salutari regole, e providenze, che abbiamo credute più efficaci, ed addattate alla graue conseguenza, trouiamo necessario di aggiungerui quell'altre ordinazioni, e cautele, che a maggior presidio della materia si reputano conferenti anco con il parere di questo Spettabile Colleggettò, e quindi

con la pubblicazione del presente ad uniuersale intelligenza chiamar tutti in generale, ed ogni uno in particolare alla più puntuale, ed esatta esecuzione, in pena della uita, in cui caderà irremissibilmente chiunque osasse di contrauenire in alcuna benchè minima parte.

Confermandosi perciò quanto è stato preffisso con il Capitolo X^{mo} della Terminazione precedente, cioè, che gli abitanti stessi de Borghi, abbiano, e debbano trattenersi chiusi, e custoditi nel Recinto delle rispettiue Case finche dalli Deputati stabiliti siano consumate le destinate giornalieri uisite all'effetto, e nei modi più precisamente espressi, si dichiara di presente, con la mira di promouerne l'adempimento, e di togliere ad un tempo alla malizia qualunque pretesto, che al terminar delle uisite medesime sarà dato un segno distinto con la Campana delle Chiese Maggiori.

A questo segno sarà lecito, e permesso al solo Capo di Famiglia per le necessarie prouuigioni de uiueri a' suoi Domestici di uscir di Casa, chiudendo tutti gli altri in essa, li quali tutti douranno rigorosamente trattenersi nelle rispettiue Stazioni, senza mai per il periodo di giorni quaranta poter uscire per qualsiuoglia causa, in pena della uita.

E perchè se alcuno fosse tanto temerario di contrauenire ad una così prouida ordinazione possa anco facilmente essere conosciuto, e distinto, si prescriue, che tutti li Capi di Famiglia abbiano imediatamente darsi in nota ai Deputati alle Visite, per esserne da essi tenuto registro, e trasmessa una Copia alla Carica, per lume, e quindi il solo, che sarà dato in Nota, e non altri, s'intenda quello, che sarà in libertà di poter all'oggetto proposto uscir dalla propria Casa, il quale poi nella necessità indispensabile di prouedersi d'acqua, potrà seco condurre ai Pozzi comuni la propria Moglie, o la Figlia, ouero la Sorella, o Serua, con obbligo preciso di starui sempre a latto, e di subito ricondurla lui stesso alla Casa, doue rinserrarla, onde pur essa si mantenga al destino degl'altri.

Si dichiara inoltre, che alle ore uentitrè di cadauno giorno durante la quarantena sarà dato un nuovo segno di Campana, in uista del quale abbia ogn'uno, e debba senza alcuna fraposizione di tempo a rimettersi alle rispettiue abitazioni, da doue non sarà pure agli stessi, niuno eccettuato, più permesso di uscire fino all'altro tocco di Campana della mattina seguente, in pena della uita.

Con la mira poi, che questo interdetto non si renda inofizioso, ma se n'abbia anzi a riceuere utile uantaggio, in altro modo s'incaricano i Deputati suespressi di prescriuere ad ogni Casa, escluse già l'infette, e le sospette, le quali rese uacue delle persone, deuono continuar chiuse, e ben custodite, e di ponere allo Sboro netti gli effetti loro suscettibili, e giornalmente uentilarli, affinchè assicurarsi da ogni, e qualunque sospizione, che in così gelosa materia ui potesse correre, incaricandosi li rispettiui Deputati a uegliare con ogni diligenza, perchè da ogni, e qualunque Casa sia di giorno in giorno così eseguito.

Il presente dourà essere accompagnato al Spettabile Colleggetto, per l'effetto, che sia ben tosto fatto pubblicare in cadaun Borgo, per il suo puntuale adempimento. In quorum fidem etc.

Spalato 14. Gennaro 1763 M. V.

(Atti del Provveditore Generale Pietro Michiel, Libro I, Carte 116-117.)



NOI PIETRO MICHIEL etc.

Per le nuoue scoperte, che si uanno facendo alla giornata di persone attaccate dal pestifero morbo in questi Borghi, abbiamo giusto mottiuo di dessumere, che non uenga prestato il douuto puntuale adempimento alle salutari ordinazioni da Noi preffisse nel proposito, specialmente con li Capitoli 2, 3, 6, 7, della Terminazione Nostra dei 12 Gennaro scaduto, fatta pubblicare nei Borghi medesimi, a notizia uniuersale, e consegnata alli rispettiui Deputati in quella parte, che riguarda le rispettiue loro ispezioni.

Ignote tuttaua le cause del grauissimo disordine, da cui principalmente ne deriua la continuazione de funesti progressi, rendendosi perciò inutili li mezzi, e li prouedimenti sino ad ora addattati per arrestarne il corso, trouiamo necessario col presente Nostro di richiamare rissolutamente all'osseruanza le ordinazioni accennate, aggiungendo quel di più, che riputiamo ualeuole nelle presenti contingenze a promouere il desiderato effetto.

Facciamo però publicamente intendere, e sapere : .

Che qualunque persona di qualsiouglia condizione abitante ne

Borghesi sudetti si sentisse o sospettasse di essere colpita dal Morbo, debba manifestarsi immediate non solo alli propri Domestici, ed a chiunque altro se gli presentasse, ma altresì al Deputato, o Capo del Sestiere cui spetta, per le prescritte ulteriori disposizioni, poichè uenendo di scoprirsi in altro modo, sarà iremissibilmente fatto moschettare prima, che soccomba alla uiolenza del male, ed alla pena medesima si intenderanno pure incorsi li Congiunti, e specialmente il Capo della Famiglia, non meno che qualunque altro fosse concorso a tenere occulte il male.

Neccessarie le medesime auuertenze nelle correnti gelosie anco per quelli, che si trouassero sorpresi da mali d'altro genere, saranno egualmente nell'obbligo di manifestarsi senza il minimo ritardo al Deputato del suo Sestiere, per le opportune uerificazioni, ed in caso di trasgressione incorreranno nella stessa pena della uita.

E siccome è probabile, e l'esperienza lo dimostra, che le nuoue scoperte infezioni traggano l'origine da robbe, ed effetti usati, o maneggiati antecedentemente da persone infette, ed in seguito trattenuti, ed occultati nelle rispettiue Case, o in altri luoghi, douranno tutti quelli, che auessero, o ritenessero appresso di se per qualunque ragione, titolo, e causa delle accennate robbe, ed effetti di qualunque genere palesarle immediate alli rispettiui Deputati, in pena irremissibile della Vita, promettendo intanto loro per questa uolta l'impunità, per auerle tenute occulte, e la sicurezza assieme d'essere pontualmente restituite alli Proprietarij doppo il competente espurgo.

Dello stesso modo saranno tenuti a manifestare le robbe, che per auuentura s'attrouassero in qualche luogo nascoste o sepolte di ragione delle persone estinte, o attualmente infette dal morbo quelli, che ne tenessero qualche traccia o indizio, ben certi di conseguirne premio corrispondente, per cui si risserua opportunamente la Carica, ma nel caso risultassero in qualche modo, ed in qualsisia tempo colpevoli dell'osseruato pernicioso silenzio, soggiaceranno alla sopradetta pena della Vita.

Dipendendo principalmente dall'opera de Deputati, o siano Capi de Sestieri di scoprire, e riconoscere le contrafazioni sull'Importante argomento delle persone nuouamente attaccate dal Morbo, e che auessero procurato di tenersi occulte, resta loro espressamente rinnouato l'incarico, per l'uso delle maggiori diligenze, e perquisizione all'occasione delle prescritte giornaliere uisite delle

persone tutte, niuna eccettuata delle Case dei rispettiui Sestieri, le quali persone con li metodi stabiliti ad una per una doueranno da loro rincontrarsi, ed esigersi sul fatto li più ueridici, e sicuri riscontri dello stato di salute di cadauna, con l'assistenza del Chirurgo, ed in caso di minima ommissione, o negligenza, che uenisse a scoprirsi nelli Deputati medesimi, soggiaceranno pur essi alle pene più seure prescritte dalle Leggi di Sanità.

Si repplica anco col presente alli Deputati stessi, o siano Capi di Sestieri l'altra non meno esenzialissima incombenza, perchè giornalmente siano uentilate, e posti allo Sboro gli effetti tutti suscettibili delle Case non infette delli predetti Borghi, a tenor del Proclama della Carica 14. Gennaro scaduto.

Il presente dourà essere trasmesso a questo Spettabile Colleggetto di Sanità, non che al Sopraintendente general Colonello Cicauro per lume, e per la rispettiua sua pubblicazione in cadauno de Borghi sudetti, sicchè cada a cognizione uniuersale, e prestarsi abbia da ciascheduno per la parte, che le incombe il pontuale suo adempimento. In quorum fidem etc.

Spalato li 6. Febbraro 1763. M. V.

(Atti del Provveditore Generale Pietro Michiel, Libro I, Carte 119-120.)

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Proclama in materia di sanità per l'armo della linea ond'impedire l'introduzione del contagio.

NOI PIETRO MICHIEL etc.

Ha impegnato le Nostre più serie applicazioni fino da primordj dell'intrapreso Generalato la molesta insorgenza del Contaggio nella Città del Serraglio, da cui diramatosi in seguito a Fionizza, Zeppe, Prussaz, Scopie, nelli Vacup, et in altri luoghi della Confinante Bossina, uà tuttauia serpendo con funesti progressi, e si traspira già auuanzato nelle uicinanze del Triplo, e sopra la Confinazione d'Imoschi. Con la mira però di tuttelare da sourastanti pericoli la salute della Prouincia, si è rinforzato l'armo dell'intiera Linea con Milizia regolata, ed abenchè sempre ferme sul graue

argomento le regole già stabilite dall'autorità del Magistrato Eccellentissimo alla Sanità degli Eccellentissimi Proueditori Generali Nostri Precessori, e Proueditori sopra la Sanità in Provincia, non che dall'ordinarie Rappresentanze, e Colleggetti delle rispettiue Città, e Fortezze, abbiamo estese ad ogni modo in cadauna parte tutte quelle maggiori precauzioni, e prouidenze, che riputassimo non meno utili, che necessarie al fine proposto con Lettere Nostre, e Proclami a tutte le Frontiere, e loro N. N. H. H. Rappresentanti, e con pressantissime commissioni rapporto al debito degli instituiti Sopraintendenti, ed Inspettori alla Linea, de Capi de Territorj, dei Corpi uolanti, e del procedere delle Carauane andanti, e uenienti. Ma per assicurare maggiormente gli esenzialissimi riguardi della gelosa materia, e preuenire più che sia possibile le conseguenze di qualunque minima licenza nell'importante proposito, in uista massime del genio scorretto de Territoriali ripugnante alla disciplina, trouiamo opportuno di richiamare a memoria, et alla puntuale osseruanza le corse ordinazioni, ed aggiungerne dell'altre, onde adempite dal canto Nostro le parti tutte dell'umana diligenza, altro non resti che d'inuocare sopra di esse la protezione Diuina. Facciamo però col presente Proclama pubblicamente intendere, e sapere, essere Nostra ferma, e risoluta uolontà, che sotto pena iremissibile della Vita abbiano ad eseguirsi in cadauna parte da qualsiouglia condizione di persone tutte le seguenti regole e prescrizioni.

Primo.

Non dourà che si sia oltrepassare nello Stato Ottomano, senza gl'indispensabili Passaporti rilasciati dal Pubblico Rappresentante per li quali dourà esibire in quell'Ufficio idonea pieggiaria di restituirsi alla propria Casa, rassegnandosi al Posto destinato, per essere poi assoggettato al prefisso periodo dell'espurgo.

2^{do}.

Le persone, e Famiglie Suddite de rispettiui Territorj, che a motiuo de loro negozij, ed interessi tuttaua s'atrouano di là della Linea entro le Tenute Ottomane, douranno nel recedere parimenti rassegnarsi ai Posti destinati sopra la Linea stessa, ed assoggettarsi alle già prescritte riserue, ed espurghi, con quelle

maggiori auuertenze, che saranno credute opportune dalli N. N. H. H. Publici Rappresentanti.

3^o.

Resta assolutamente proibito qualunque transito, e regresso de Sudditi Nostri dal Paese Ottomano con Animali, Merci ed effetti suscettibili, poichè in riguardo al bisogno del commercio attiuo, e passiuo con li Sudditi Turchi per occasioni di uendite, e permuta dei generi permessi, dourà ciò intendersi accordato in quelli soli luoghi del Confine a tal oggetto destinati, e custoditi di guardie, con le condizioni, e regole praticate in simili casi, e prescritte agl'Inspettori, e Direttori de Posti, doue aueranno a ridursi per le uie solite, e notorie.

4^{to}.

Tuttoche pressidiata la Linea, non impossibile però, che s'auuanzi la temerità di alcuno d'introdursi clandestinamente, deludendo la uigilanza delle guardie, resta rigorosamente uietato a chiunque di accompagnarsi in uiaggio, o dar ricetto in qualsiuoglia luoco sotto qualunque imaginabile colore, o pretesto a simili persone, o alli loro Animali, et effetti.

5^{to}

Per impedire le furtiue introduzioni douendo inuigilare, e tenersi in continuo mouimento li Corpi uolanti a ciò destinati, coll'arrestare li contraffattori, e li loro effetti, inseguirli, et anco amazzarli in caso di fuga, o di resistenza, auranno tutti gli effetti fermati da applicarsi a beneficio, e mercede di essi Capi uolanti, salua sempre la ricognizione nelle respettiue Bazzane degli effetti non suscettibili, lo sguazzo degli Animali, ed altresì il formale, e più regolato cspurgo per le robbe suscettibili nelli Lazzaretti di Spalato.

6^{to}.

Di cadaun fermo che fosse esequito dourà il Direttore del Corpo uolante farne consapeuole il più uicino Capoposto, perchè partecipato da questo il natural suo Rappresentante, siano successiuamente auuanzate le notizie alla Carica.

7^{mo}.

Nel caso, che dai Corpi uolanti si usasse trascuragine maliziosa, dissimulazione, o concerto con li malfattori, o si mescolassero pur maliziosamente con persone, e robbe sospette, doueranno da Capiposti, e Direttori, o da qualunque altra persona, cui cadessero a notizia tali trascendenze esserne imediate partecipata la Publica Rappresentanza, con la sicurezza anco d'essere tenuto secreto, e premiato il Denonciante.

8^o.

Anco le Sentinelle, e Guardie de Caselli alla Linea, allorchè mancassero nella debita uigilanza, e pontualità cosi nel star fisse a proprij Appostamenti, come nell'opponersi risolutamente a chiunque tentasse d'introdursi clandestinamente nello Stato, saranno imediate leuate dal Posto, e consegnate nelle Forze di quel Publico Rappresentante, nella di cui Giurisdizione uenissero di scoprirsi tali mancanze, per l'esemplare loro castigo.

9^o.

Sarà obligo preciso de Capi, e Direttori rispettiui di frequentare le uisite di giorno, e di notte alli Posti, per tenere nell'esercizio puntuale dei loro doueri le guardie, e prouedere sul fatto a qualunque disordine, che ui scoprissero.

10^{mo}.

Inuigilaranno egualmente con particolar cura, ed auuertenza li Capi, ed Inspettori nei luoghi destinati al Confine per le permesse permute, e uendite, affinchè osseruandosi, come fu loro prescritto, le più scrupolose risserue, non siano prettese indebite contribuzioni, e praticate estorsioni dalle guardie, o altri, a pretesto di regalie uerso li Sudditi, che si presentassero per il riferito motiuo, sopra di che saranno sempre responsabili alla Carica li Capi, ed Inspettori sudetti.

11^{mo}.

Infermandosi alcuno nelle Ville con qualche accidente di sospetto, sarà debito preciso di quel Karambassà di portarne l'auuiso con tutte le circostanze al Capoposto più uicino, e da questo parteciparsi imediate l'Uffiziale Superiore, da cui sarà sollecita-

mente auuertita la Publica Rappresentanza, per farne praticare le necessarie uisioni col mezzo di Medico, o Chirurgo, o di altre esperte persone, onde rileuare la precisa qualità del male, non permettendo frattanto la comunicazione di quella con l'altre Case, e Famiglie, che dourà anzi essere custodita con particolare gelosia dalle Guardie.

12^{do}

Succedendo la morte di alcuno improvvisamente, dourà subito segregarsi egualmente quella Famiglia dal commercio con le altre, et appostarsi guardie a proporzione del sito, nè seppellirsi il cadauere fino a tanto che non siano praticate le prescritte osseruazioni d'ordine della Publica Rappresentanza, da parteciparsi sollecitamente dell'emergenza come sopra.

13^o.

Già fissate le regole per l'introduzione, e scorta delle Carauane prouenienti dallo Stato Ottomano, massime con la prouida Terminazione dell'Ecc.mo Signor Proueditore alla Sanità Contarini 15. Maggio 1732, non è da dubitarsi, che genti, e Caualli dal corpo di esse possano distraersi in uiaggio, o uiolare le gelose riserue, sempreche ui si presti la prescritta uigilanza, al qual effetto si eccita la lodeuole attenzione delli rispettiui N. N. H. H. Rappresentanti di applicarsi col maggior feruore, e resta espressamente incaricata la pontualità degli Uffiziali Direttori delli rispettiui Appostamenti, e delle scorte per l'esatissima osseruanza della Terminazione sudetta.

14^{to}.

Qualora però alcun Suddito Ottomano tentasse, o gli riuscisse per auuentura d'introdursi, e penetrare nello Stato per altre uie furtiue, e clandestine fuorchè per la solita custodita, e uicendeuolmente accordata, dourà dalle Guardie al Confine, e se si sottraesse dalla loro osseruazione, dagli Uomini de Villaggi, non che da qualunque altro, in cui s'incontrasse, essere fermato, e fatto condurre dal Pubblico Rappresentante di quella Giurisdizione oue si trouasse con gli Animali, et effetti, sempre con li riguardi di Sanità alli Lazzaretti di Spalato, partecipandone sollecitamente la Carica per le ulteriori deliberazioni.

15^{to}.

Non ui sia alcuno de Sudditi, che si faccia lecito d'auanzarsi al Confine all'incontro delle Carauane per contratti, o comprede, proibite queste particolarmente alla Bazzana di Sign, douendo tutte le Merci, e robbe prouenienti con le Carauane medesime essere ridotte, senza alcuna distrazione, al Lazzaretto, sopra di che resta pur incaricato della maggior uigilanza il Direttore della Milizia, che s'attrouasse destinato in loro scorta.

Siamo persuasi, che cadauno de Sudditi uorrà uniformarsi intieramente alle premesse disposizioni, che tutte tendono all'interessante oggetto di presseruare la commune salute, ma se nonostante ui fosse alcuno cosi peruerso, che s'auanzasse a trasgredirle, giustificata la colpa, l'accusatore, che comparisse a denonziarlo, oltre di essere tenuto secreto, riporterà il premio di dieci Ducati, da essergli esborsati dalla Cassa del Generalato.

Registrato il presente nell'Ufficio della Segretaria Nostra, e tradotto in Illirico, sarà accompagnato alli N. N. H. H. Rappresentanti delle Frontiere, Sopraintendenti, e douunque occorresse, per la sua publicazione, che dourà replicarsi ogni quindeci giorni, e diffondersi dalli Collonelli, e Capi de Territorj, ad uniuersale intelligenza per le Ville, e Posti anco della Linea, sichè conseguire quel frutto salutare, che dalla pontuale sua osseruanza saprà promettere particolarmente il zelo sempre attento delli stessi N. N. H. H. Rappresentanti. In quoruin fidem etc.

Zara, primo Giugno 1763:

(Atti del Provv. Gen. Pietro Michiel, Libro I, Carte 39-42.)

NOTES.

1. — PIETRO MICHEL fut gouverneur général de la Dalmatie et de l'Albanie pendant les années 1763 à 1765.
2. — *strepitosi apparati* : Il n'y avait pas de menaces de guerre en 1763. L'auteur pense sans doute ou à des préparatifs de guerres antérieures ou à des incidents de frontière fréquents entre les deux races.
3. — Serraglio = Sarajevo. D'après SCHNURRER : *Chronik der Seuchen*, 1825, II p. 333., l'épidémie de peste commença en 1759 en Syrie, à Sidon et à Chypre. Voyez aussi STICKER : *Die Pest*, I, p. 250.
4. — *caravana* : Les caravanes allaient de Sarajevo en Dalmatie en passant par Livno, Sign et Clissa, mais il y avait aussi d'autres routes très fréquentées. On apportait à Spalato des marchandises qui devaient être exportées ou distribuées à Zara, Trieste et Venise.
5. — Dans les ordonnances (*Terminazione in materia di sanità per il contagio sviluppatosi ne' Borghi di Spalato*) rendues le 12 janvier 1763 par PIETRO

MICHIEL et qui avec quelques autres déclarations postérieures constituent le *Règlement*, qu'on suivit pendant l'épidémie, il est constaté que la peste se montra le 19 décembre 1763 dans le faubourg Borgo Grande de Spalato. De là, la maladie se propagea aux autres faubourgs. Il est stipulé que les édits et ordonnances, antérieurement en vigueur et appliqués pour la dernière fois en 1731, conservent toujours force de loi. (*Atti del Prov. Gen. Pietro Michiel 1763-1765*, Libro I cc. 110-116). Du jour indiqué, on peut inférer que la maladie était répandue et reconnue parmi les habitants au moins deux mois avant que les autorités de la ville n'eussent consenti à y reconnaître la peste. En négligeant même ce que le Ms. dit pour Octobre et Novembre, on s'étonne, la peste étant constatée le 19 décembre, de voir tolérer une procession propitiatoire solennelle le 17 du même mois.

6. — La ville de Spalato est enfermée dans les murs du grand palais, bâti par DIOCÉTIEN; en dehors se trouvent les faubourgs : vers l'ouest Novi Grad et Borgo grande, vers l'est Lučac et vers le nord Manuš et Pozzobon.
7. — *toccato* : FRACASTORO fut le premier à soutenir, que l'infection peut être propagée par les objets et par le contact (*De contagionibus*). Dans le même livre il distingue des fièvres malignes la peste bubonique.
8. — GIOVANNI CARLO CASTELLI, neveu du médecin FRANCESCO CASTELLI. Le 16 mai 1762 il obtint la charge de médecin des lazarets avec la mission spéciale d'inspecter les caravanes et d'annoncer les cas de maladie qui se montreraient dans leurs rangs. (*Atti del Prov. Gen. Francesco Diedo, 1760-62*, Libro III cc. 176-177.) Il était en fonctions le 23 mai 1767, quand un certain Dr DANIELI devint son successeur « col riflesso non solo ai suoi requisiti, e cognizioni richieste, ma ancora al buon servizio, da esso prestato nell'ultime molestie insorgenze della Dalmazia ». (*Atti del Prov. Gen. Antonio Renier, 1766-68*, Libro I, c. 160.)
9. — SILOVICH, ANTONIO : Biographie inconnue. Dans une lettre du 15 octobre 1793 il est nommé chirurgien à Spalato. Il devint chirurgien à Narenta le 25 octobre 1793, comme successeur de SPIRIDION MEDIN, mort peu de temps avant (*Atti del Prov. Gen. Alvisé Marin 1793-95*, Libro II, c. 35.)
10. — *Poissan* : Église de pèlerinage, près de la côte, à l'est de Spalato et au sud de la route d'Almissa.
11. — DELFINO (DOLFIN), ANTONIO : gouverneur de Spalato du 1 août 1762 au 22 avril 1765. Le grand mérite de DELFINO est, d'avoir, à un moment où les autorités n'avaient publié aucune ordonnance contre l'épidémie, tendu un cordon militaire tout le long de la frontière entre la Dalmatie et la Bosnie. Il assura aussi l'isolement des faubourgs à main armée, en même temps qu'il isolait les uns des autres. Il séquestra et barricada les maisons contaminées, ouvrit des hôpitaux et lazarets pour les malades, les suspects et les convalescents. Il organisa aussi des entrepôts de désinfection pour les objets, assigna des cimetières aux pestiférés. L'organisation de petites commissions sanitaires volantes, composées d'un préposé, de quelques députés, d'un médecin et d'un chirurgien, est aussi due à son initiative. (Introduction à la *Terminazione* de 12 janvier 1763).
12. — MUZZUCATO : La charge de préposé militaire du district de Spalato et du territoire de Clissa étant vacante par la mort de GIROLAMO CAMBI, le cornette STEFFANO MAZZUCATO en fut pourvu le 11 juin 1763. Il appartenait à une famille originaire de Livno en Bosnie, c. à. d. du côté ottoman, mais qui en 1686 abandonna son patrimoine et s'expatria vers la république vénitienne après avoir obtenu du provvediteur CORNER le 1 septembre 1741 l'auto-

risation de partir en compagnie de nombreuses autres familles. Le chef de ces émigrants était FRANCESCO MAZZUCATO, qui aussitôt combattit les Turcs et montra un grand courage pendant le siège de la ville de Sign. Les frères NICOLÒ et GIACOMO MAZZUCATO se distinguèrent également à la prise de Knin, Castelnuovo et Narenta. En essayant d'étendre les frontières, GIACOMO mourut à la bataille de Livno, dans laquelle il massacra un grand nombre de Turcs, entre autre le sciliftar du pascha bosnien, duquel il coupa la tête. C'est alors à NICOLÒ que revint l'honneur de diriger l'assaut de Knin. A la tête de ses soldats, il traversa à la nage la rivière Kerka, monta le premier à l'assaut de l'ancien chef-lieu et y planta le drapeau. Il se rua sur les portes de la ville, les enfonça pour donner à ses troupes l'accès de la place. Il obtint pour toute récompense le droit de garder le drapeau de l'assaut, qu'on se transmit de père en fils dans sa famille, établie à Spalato en compagnie des autres familles bosniaques. Dès lors STEFFANO MAZZUCATO devint le chef de la famille et son guide. Le père de STEFFANO, PIETRO MAZZUCATO s'était aussi distingué; il réorganisa le commerce avec la Turquie, et fit livrer sans frais par les Turcs, à Sign une multitude de poutres pour la république vénitienne. Une pareille livraison était de grande valeur, car depuis le moyen-âge la Dalmatie était déboisée.

STEFFANO MAZZUCATO était colonel et préposé des forts et district de Spalato, du territoire Clissa et des îles adjacentes. Son traitement était de 25 ducats (*Patente al colonello Soprintendente Steffano Mazzucato, datée le 1 août 1763 à Spalato. Atti del Prov. Gen. Pietro Michiel 1763-65, Libro I, cc. 61-62*). Dans une lettre du doge ALOYSIUS MOCENIGO, datée die decima nona Januarii. Inditione duodecima MDCCL XIII les 25 ducats furent remplacés par 36 Lire (*Atti del Prov. Gen. Pietro Michiel, 1763-65, Libro I, cc. 121-22*).

Dans une autre lettre du providiteur général FRANCESCO FALIER, datée die III Marti, Ind. III MDCCL XXXV STEFFANO MAZZUCATO est nommé colonel à Sign à cause de ses bons services pendant la peste (*Atti del Prov. Gen. Francesco Falier, I, 1, 10*.) La poste de Spalato fut donné au comte SIMON BENEDETTI, qui s'était distingué pendant la peste à Clissa, sur la recommandation des brigadiers RADO et MONARI. (*Atti del Prov. Gen. Francesco Falier, 1784-86, Libro II, carte 145*).

13. — *Castelli di San Stefano e Capogrosso* : Un château de Saint Étienne ne semble pas avoir existé, et on n'a pu le retrouver sur les plus anciens plans de la ville. De nos jours Castello di San Stefano est le cimetière de la ville, fondé en 1821 sur un terrain occupé depuis le IX^e siècle par un monastère des Bénédictins. Castel Capogrosso est un château de la famille Capogrosso à l'ouest de S. Stefano. Ces lazarets furent surveillés par les députés sanitaires de concert avec un chirurgien. (Comparez le § 4 des *Obblighi dei Deputati, Medici, Chirurghi ed altri* (appendice p. 5). Le lazaret de Capogrosso était destiné aux suspects, conformément aux propositions de NICOLAO MASSA qui fut des premiers à proposer des mesures prophylactiques d'État contre la peste, mesures adoptées par le Sénat vénitien. Elles comportaient l'érection de deux hôpitaux dans une ville contaminée, l'un pour les malades, l'autre pour les suspects, surtout ceux ayant communiqué avec les malades ou appartenant à leur famille.
14. — *Lazzaretti* : Le lazaret existe encore, transformé en prison. Il est situé dans la rue Put Tamnica, hors les murs du palais de Dioclétien et près de la tour de Sud-Est du palais de Dioclétien. La prison montre encore une

chapelle de St Roch, et les grandes cours de l'ancien lazaret, les constructions étant demeurées à peu près telles qu'autrefois.

15. — L'activité de DOLFIN comme organisateur de la bienfaisance et des secours aux indigents est attestée au § 5 de *Obblighi dei Deputati, Medici, Chirurghi et Altri* (Appendice p. 6).
16. — *Botticelle* : Langue de terre qui termine le port de Spalato vers l'Est. Allusion au fait que ce port a la forme d'une bouteille de vin, dont le goulot est placé entre Botticelle et St. Stefano.
17. — *Paludi* : Le couvent de Santa Maria dei Paludi est situé au Nord-Ouest de Spalato près du fond du canal castelli.
18. — Voyez le § 1 de la Terminazione de 12 janvier 1763. (*Atti del Prov. Gen. Pietro Michiel*, Libro I, cc. 110-116; Appendice p. 7).
19. — RADO, PIETRO : Dates biographiques inconnues. L'ordonnance du 12 janvier 1763 le nomme surintendant (soprintendente) en même temps que le MAZZUCATO déjà cité.
20. — PINELLI : PAOLO PINELLI, dont les dates de naissance et de mort restent inconnues. Il fut nommé préposé sanitaire (physicus) temporaire à Traù le 19 août 1741 par le provvediteur général MARIN ANTONIO CAVALLI (*Atti del Prov. Gen. Marin Antonio Cavalli*, 1738-41, Libro I, c. 261-262), il était donc le successeur de PIETRO PINELLI, nommé le 16 avril 1716 par le provvediteur général ANGELO EMO (*Atti del Prov. Gen. Angelo Emo*, 1714-17, Libro III, cc. 213). PAOLO était fils d'ORAZIO PINELLI (n. 1694, m. vers la fin d'avril 1764), protomédecin de la Dalmatie pendant plus de 30 années, et qui s'était fait remarquer pendant la peste de 1731-32 à Castel Abbadesa et dans les faubourgs de Spalato. Comme il était alors plus que septuagénaire, le Doge lui permit par une lettre du 21 avril 1764 de prendre, sans frais ou dépenses publiques, son fils PAOLO comme assistant ; mais il mourut avant que cet arrangement entrât en vigueur. PAOLO lui succéda dès lors dans ses charges (*Lettre de Zara*, le 1 septembre 1764. *Atti del Prov. Gen. P. Michiel* 1763-65, Libro I, c. 166), qu'il conserva pendant vingt-deux années. PAOLO, lui aussi, devint à peu près septuagénaire, et fut également forcé de demander aide pour remplir ses engagements, qui comprenaient en outre le service sanitaire des hôpitaux militaires et marins. Son fils ORAZIO, qui avait longtemps pratiqué à Zara et accompagné son père pendant ses tournées de service en Bosnie, devint son aide (*Atti del Prov. Gen. Francesco Falier*, 1784-86, Libro II, c. 314-15). Une lettre du Doge, datée du 31 mars 1787 lui ordonna d'entrer dans la charge paternelle après la mort de PAOLO (*Atti del Prov. Gen. Anzolo Memo*, IV, 1787-89, Libro III, c. 115.). Le 2 janvier 1791 on augmenta le salaire de PAOLO PINELLI de 8 ou 9 sequins en considération de ce qu'il avait exercé la même charge pendant plus de vingt-neuf ans, que cette charge était restée dans sa famille pendant plus de 60 ans, qu'il s'était rendu en Bosnie à diverses reprises, et qu'il avait combattu deux fois les épidémies, sans compter les épizooties. (*Atti del Prov. Gen. Alvise Marin*, 1793-95, Libro II, cc. 27-28.)
21. — SAJANO : Les archives de l'État à Zara ne possèdent aucun renseignement sur ce médecin.
22. — ZICCAVO (CICAVO), GIOVANNI CARLO PAGANELLI, dont les dates biographiques sont inconnues, fut nommé le 12 décembre 1766 gouverneur de Zara par le doge ALOYSIUS MOCENIGO. La nomination est enregistrée le 30 mai 1767 dans les *Atti del Prov. Gen. Antonio Renier* 1766-1768, Libro I, c. 110. On le fit passer plus tard à Cattaro, où il est qualifié en 1769 de sergent

major de bataille (*Atti del Prov. Gen. Domenico Condulmer 1769-1771* dans les *Dispacci al Serenissimo Principe di Venezia*, Libro I, carte 96).

23. — *Pozzobono* : cf. la note n° 6. Les grandes routes de la Bosnie passent par les faubourgs du Nord, Pozzobon et Manuš, de Spalato.
24. — *marcato* : Dans la législation d'État, ou communale, la précaution de marquer les maisons pendant les épidémies de peste apparaît d'abord en France vers 1500, plus tard en Italie et ailleurs. On lit dans les « Ordonnances faictes et publiées à son de trompe par les carrefours de ceste ville de Paris » (1531) qu'on employait une croix de bois : « Qu'ilz aient a mettre ou faire mettre es fenestres des-dictes maisons ou aultre lieu plus apparent vne Croix de boys. Et au milieu de la principale porte, huys, et entrée du dict hostel vne autre Croix de boys clouee et fichee contre les dictes portes et huys. A ce que chascun en puisse avoir congnoissance et soy abstenir y entrer ». (CHÉREAU, p. 116). A Spalato cette mesure fut prescrite par le § 2 des *Obblighi dei Deputati, Medici, Chirurghi ed altri* (Appendice p. 5). — Il ne faut pas confondre cette précaution avec la coutume, bien connue en Italie, de peindre des caractères ou lettres de conjuration sur les murs des maisons pour écarter la contagion. (STICKER l. c. p. 410 et ANDRÉE-EYSN : *Volkskundliches aus dem bayrisch-oesterreichischen Alpengebiet*, Braunschweig, 1910 qui contient l'article *Das Tau und die Pestmulette* p. 63-72.
25. — *Magazzino* : L'endroit où ce magasin était situé demeure inconnu; le texte ultérieur du manuscrit montre que ce magasin était le lieu de distribution des objets à désinfecter provenant de Capogrosso, San Stefano et Lučaz. Cavana est, en langue Croate, un café. Monseigneur BULIĆ m'informe que le mot *cavana* peut être une erreur de manuscrit. Il faudrait sans doute lire *canava* (*canova*), mot italien qui désigne un cave pour le vin (*cantina*). Dans ce cas une telle cave, d'assez grandes dimensions, aurait été employée pendant la peste, comme lieu de désinfection et de distribution; elle était sise dans la grande rue du faubourg de Lučac, menant à l'église déjà mentionnée de Poissan.
26. — *40 giorni* : Le conseil municipal de Raguse avait — le tout premier — par décret du 27 juillet 1377 prescrit une quarantaine d'un mois, c. à. d. 30 jours, à tous les étrangers, qui désiraient entrer en ville et qui venaient des lieux contaminés par la peste. Ce laps de temps se montra insuffisant et fut augmenté de dix jours, quand la première station de quarantaine fut installée à Marseille en 1383. Plus tard on fixa une période fixe de quarante jours. Il est étonnant que la *Terminazione* de 12 janvier 1763 ne fixe pas la durée de la quarantaine et même en traite largement les modalités. Les 40 jours ne furent précisés que deux jours plus tard par l'ordonnance de 14 janvier 1763.

On décréta aussi dans la première ordonnance que la ville devait être divisée en quartiers, sans spécifier combien. Sans doute y en avait-il six, sinon plus, car ce nombre est attesté dans la codification des règles sanitaires, due au providiteur général FRANCESCO FALIER pendant la peste de 1784, c. à. d. seulement vingt ans après l'épidémie dont nous traitons ici. Dans chaque quartier on désigna un chef (*capo di contrada*) pour visiter en compagnie du chirurgien et de la garde, les maisons séquestrées (*Obblighi* § 1.) Il était formellement interdit aux occupants de quitter leur maison; seuls les pères de famille et un domestique pouvaient sortir, garantis par un laissez-passer, pour se procurer des denrées alimentaires. On sonnait les cloches de l'église pour avertir du commencement et de la fin de l'inspection. (*Ordonnance* de 14 janvier 1763 et *Terminazione* de 12 janvier 1763).

27. — *Salona* : Dans l'antiquité, Salona était la ville la plus importante de la Dalmatie. Quand les Goths en 535 et les Avars en 614 l'eurent détruite, les habitants cherchèrent abri derrière les murs du palais de DIOCÉTIEN à Spalato et y restèrent. De nos jours la ville de Salona est bâtie sur les ruines de la ville antique. Le fleuve Jader a son embouchure dans le Sinus salonitanus (canale castelli), au Sud de la ville, qui toujours est célèbre par ses moulins. BRÜNNICH, qui visita Salona en compagnie de GIULIO BAJAMONTI, alors jeune homme, donne une esquisse de la région et parle amplement de la construction des moulins. (voyez planche B).
28. — ARNERICH, GIOVANNI (ZUANNE). Les dates suivantes sont tirées des lettres patentes émises le 3 mai 1760, nommant ZUANNE ARNERICH capitaine du régiment Macedonia (*Atti del Prov. Gen. Francesco Diedo*, 1760-62, Libro II, cc. 87). Son père était le capitaine GIROLAMO ARNERICH, qui sacrifia sa vie pour la défense de Torre di Norino pendant les guerres avec la Turquie. Son père PIETRO lui succéda comme chef de compagnie; quand il mourut pendant la guerre, ZUANNE le remplaça, et après en avoir la charge temporairement il devint porte-enseigne jusqu'en 1741; il était en même temps adjudant de régiment. Il se fit remarquer pendant les épidémies antérieures en Dalmatie, en Frioul et à Polesene et fit un bon service dans les districts côtiers et dans la forteresse de Palma, pendant le voyage de la reine de Naples, MARIE AMÉLIE. Puis il fut envoyé dans le Levant, à Preveza et à Voniza, où il s'engagea dans l'armée formée contre les Turcs, qui s'étaient avancés pour détruire les habitations de la plaine de Voniza. Il avait aussi rendu de signalés services dans la marine. (*Atti del Prov. Gen. Francesco Diedo*, 1760-62, Libro II, cc. 91-92 et III cc. 135.)
- ZUANNE ARNERICH fut nommé le 23 août 1765 gouverneur de Sebenico. Il existe encore d'autres lettres patentes concernant sa nomination au grade de colonel, datées de Cattaro, le 20 septembre 1770 (*Atti del Prov. Gen. Domenico Condulmer*, 1769-71, I libro II, cc. 81). On y voit qu'il était entré dans l'armée dès son jeune âge; en 1716 il suivit comme chef de compagnie le corps auxiliaire envoyé au secours de la forteresse de Strumizza. Il détint cette charge jusqu'en 1731, et devint alors sergent major. Plus tard, en 1768, il fut nommé lieutenant-colonel au régiment d'outremer du colonel PIETRO RADO. Ces patentes attestent ses bons services comme directeur des cordons militaires pendant la peste. Il reconduisit dans la république vénitienne beaucoup de familles de l'autre côté de la frontière, leur distribua du bois et des marchandises. Chargé du recrutement en temps difficiles, et directeur de la force militaire, ARNERICH fut, en dernier lieu, nommé gouverneur de Knin le 25 mai 1782 (*Atti del Prov. Gen. Francesco Falier*, 1784-86, Libro I, c. 60.)
29. — Au commencement de l'épidémie les foires, marchés et toutes réunions furent interdites. La *Terminazione*, § 4, renouvelle ces défenses, surtout quant aux enterrements. Ces prohibitions furent maintes fois réitérées jusqu'à la fin de l'épidémie. Le service divin n'est pas spécialement mentionné, mais le § 5 exhorte les prêtres à donner leur soins et à distribuer les sacrements avec les précautions d'usage. Un décret de clôture des églises fut certainement lancé, car cette prescription fut déclarée maintenue pendant la peste de 1784.

Les règlements de cette épidémie disent au § 13 : *Resta confermata la deliberazione delle Spettabile Collegetto per la chiusura di tutte le chiese di questa Città, onde non abbiano a verificarsi radunanze, le quali douranno egual-*

mente intendersi inibite in qualsivoglia altro luoco. (Le règlement de FRANCESCO FALIER du 3 avril 1784 dans les *Lettere al Magistrato sopra la Sanità di Venezia dell Sign. Paolo Boldù*, Prov. Gen. in Dalmatia et Albania. L'anno 1783, scritte dal Dott. GREGORIO STRATICO I.)

30. — Les phrases : *Si provvide ancora ai modi necessarii per condurre × accio mai tramandasse il mal odore della pestilenza* se trouvent sous la même forme dans la *Relazione del Proveditor Pietro Michiel al Senato sul morbo contagioso in Dalmazia l'anno 1764*, manuscrit de vingt feuilles autrefois dans les Archives de Zagreb. Cette partie est citée dans le livre de FR. BULIČ : *Dva Sarkofaga Ivana Ravenjanina i Lovre Dalmatinca Spljetskih nadbiskupa* — Zadar 1882. (Deux sarcophages de JEAN DE RAVENNE et de LAURENT LE DALMATE, archevêques de Spalato). — D'après une lettre du directeur le manuscrit en question n'existe plus dans les Archives à Zagreb.

Le décret sur les inhumations dans la chaux vive forme le § 3 des *Obblighi* (Appendice p. 5).

31. — *Bestie* : Le § 8 de la *Terminazione* dit que les chiens et les chats errants seront tués en raison des possibilités de contagion. Les inspecteurs sanitaires et députés devaient veiller au massacre de ces animaux, mais le règlement est muet sur le sort de leurs cadavres. Comme personne n'osait y toucher, ils restaient à l'état de charognes dans les chemins et les ruelles.
32. — *Fuochi* : Voyez *Regole per l'espurgo delle cose infette* § 2 (appendice p. 9). La désinfection par le feu était faite par des parfumeurs (*profumatori*) portant des torches de genièvre et de romarin. Avec celles-ci on flambait les murs, plafonds et coins.
33. — Le § 2 de la *Terminazione* dit que quiconque se sentira malade en devra immédiatement aviser le député afin qu'on puisse prendre de suite les précautions nécessaires. Cette ordonnance concernait autant les pestiférés que les malades d'autres catégories. La peine de mort était portée contre qui célerait les cas; on suivit ainsi les règles employées à Majorque en 1714 et adoptées par la république vénitienne, qui en 1504 avait conféré au Conseil de Santé le droit de vie et de mort pour toutes infractions aux règlements contre la peste. (STICKER II, p. 297.)
34. — *Nota* : voyez *Obblighi* § 1.
35. — *Caselli di tavola* : Des hangars, cabanes ou seulement abris provisoires sont signalés dans plusieurs épidémies italiennes de peste, employés concurremment avec les lazarets, une fois complets.
36. — *Tuellio, Giorgio* : Biographie inconnue; il appartient à une ancienne famille noble de Spalato.
37. — Les inspecteurs des lignes devaient parer aux vols. Leur ordre était d'arrêter les larrons ou de tirer sur eux, s'ils prenaient la fuite (*Terminazione* § 11).
38. — *Bastaggi* = Bastasi (du grec *Βασταγω*) = portatori, facchini : Les portefaix étaient de deux sortes, nets et impurs. Les premiers recevaient les objets des maisons contaminées et les portaient aux locaux de désinfection, où ils étaient reçus par les nets. Le curé ou quelque autre ecclésiastique devait enregistrer les objets, inventorier les effets des familles et les marquer afin de les rendre plus tard aux possesseurs (*Metodo per gl'espurghi* § 8 et 9; appendice p. 8).
39. — *Sta Croce* est le même faubourg que Borgo grande; il prend son nom de l'église paroissiale de Ste Croix.
40. — PETROVICH, PIETRO : Dates de naissance et de mort inconnues, mais on peut inférer de divers documents des Archives de Zara, que sa famille s'était

fait remarquer pendant les guerres de Candie, en Dalmatie, au Levant, aux Dardanelles, pendant l'expédition contre Elgena, à la conquête de Volo et pendant le siège de Malvasia. En particulier le capitaine de cavalerie DOMENICO PETROVICH et le colonel FERDINANDO PETROVICH avaient montré un courage peu ordinaire. Ce dernier avait assisté à l'assaut de six villes diverses, participé à la bataille d'Argos et dans huit combats navals reçu maints horions sérieux, dont le pire fut une fracture de la jambe droite, survenue à l'assaut de la brèche de Negroponte. Les frères GASPARO et PIETRO PETROVICH, capitaines, se firent également remarquer. Le dernier fut fait prisonnier à Modon, devint esclave et finit sa vie dans les bagnes turcs; son frère reçut une arquebusade ennemie à la défense de Corfou.

PIETRO PETROVICH, mentionné ici, entra à l'armée comme porte-enseigne (alfiere), devint plus tard lieutenant, adjudant de régiment et de brigade, capitaine-lieutenant et fut le 17 juillet 1760 nommé sergent-major de régiment. Sa nomination fut approuvée par une lettre de doge de 23 décembre 1760; sa nomination de capitaine suivit le 26 mars 1761. (Lettres du 30 janvier 1761 dans *Atti del Prov. Gen. Francesco Diedo*, 1760-62, Libro III, cc. 138-139, et du 15 avril 1761, ibidem, cc. 72-73, toutes deux de Zara.) Il fut nommé gouverneur militaire de Spalato le 17 juin 1765 (*Atti del Prov. Gen. Pietro Michiel*, 1763-65, Libro I, c. 226) à la mort de son prédécesseur le colonel, comte PIETRO GELLICH. Enfin, il fut gouverneur militaire de Cattaro le 3 mars 1774. (*Atti del Prov. Gen. Giacomo Gradenigo*, 1775-78, Libro II, cc. 24.)

41. — *Il metodo* : Ce que le manuscrit dit de la désinfection des maisons, chambres et objets concorde avec les décrets des *Regole per l'espurgo delle cose infette* (appendice p. 9). Il suit les préceptes de désinfection que GIAN GAL-EAZZO VISCONTI avait proposés en 1399. (voyez CORRADI: ANNALI, I p. 246.)
42. — *80 giorni* : Total de la quarantaine impure et nette. Divers documents donnent des renseignements sur la fin de l'épidémie. Une ordonnance de Spalato du 1 juin 1764 dit qu'aucun nouveau cas ne s'était montré pendant les deux derniers mois; le dernier cas s'étant manifesté dans la maison BLASEVICH à Borgo Grande. (*Atti del Prov. Gen. Pietro Michiel*, Libro I, c. 144-145). Un décret de Spalato du 4 août 1764 réduit la quarantaine des soldats territoriaux à 21 jours pour la ville de Spalato (l. c.; c. 159); un autre édit, daté de Zara, le 3 septembre 1764, réduit la quarantaine à Spalato à sept jours seulement. Les faubourgs de la ville sont en même temps mis en libre communication avec les districts voisins, avec Traù, le littoral, le district des montagnes et Clissa; mais en cette dernière localité la quarantaine devait encore durer quatorze jours.
43. — *Doimovaz* = Dujmovača; St. Doimo, position et chapelle au Sud de Salona, près du fond de Vranjička Luka. Stobreč, l'*Epetium* des Romains, est située à 6 klm à l'Est de Spalato sur la mer. La ligne de séquestration était alors tracée de manière à exclure toute la péninsule, sur laquelle Spalato est située.
44. — PADOVEN, personnage inconnu.
45. — FLOSBERGH, personnage inconnu.
46. — *Ham*. Dans les lettres de PAOLO BOLDÙ, écrites par STRATICO, cette localité est appelée *Han*; c'était exactement là qu'on construisit le camp en 1784.
47. — CONTARINI, SIMONE, né à Venise le 27 août 1563, mort le 10 janvier 1633. Il étudia à Padoue, fit un voyage à Rome, et fut ambassadeur à Turin, en Espagne, à Constantinople auprès du sultan MAHMOUD III, et, en France. De retour à Venise il devint procureur.

48. — *Panduri* : Les morlacs formaient — sous le nom de Pandours — un corps de milice rurale, qui fut employé à la surveillance des postes militaires. Ce corps était installé dans les forts de la frontière, et les pandours servirent d'officiers aux soldats de la milice nationale, qu'ils avaient sous leurs ordres. Ils étaient réputés comme peu dignes de confiance; on les soupçonnait de prêter la main à toutes sortes de concussions. (BAJAMONTI : *Storia della peste* p. 17.)
49. — *ultima pace* : La Dalmatie vénitienne était divisée en trois parties, 1. les domaines anciens, qui comprenaient toutes les îles et villes du littoral acquises par voie pacifique, et aussi Scardona, conquise sur les Turcs. Cette partie de la province allait alors de Zara, Novigrad, Salona, Clissa à Spalato. 2. Le domaine nouveau, conquis *manu militari*, était constitué, d'après la convention de paix de Karlowicz (1699) par une partie du district de Zara, Sebenico et Traù, les districts de Knin et Dernisch et diverses parties des districts de Scardona, Spalato, Sign, Almissa, Macarsca et Narenta. La ligne de démarcation de ce domaine est connue sous le nom de « Linea Mocenigo ». 3. Les acquisitions les plus récentes, consenties aux Vénitiens après la paix de Passarowitz (1718) furent constituées par une partie du district du Sud de Knin et de Sign, une partie du district d'Almissa, Macarsca et Immoschi.

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» » » » DOMENICO CONDULMER (1769-71).

» » » » GIACOMO GRADENIGO (1775-78).

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Wave-like Fluctuations of Creative Productivity in the Development of West-European Physics in the Eighteenth and Nineteenth Centuries *

There is no doubt that creative productivity in any of the scientific fields, measured by the mass of corresponding scientific discoveries, fluctuates in different periods of the development of the given science. Of course, in general the absolute quantity of creative productivity, in correspondence with the general development of culture, at least in the last centuries, reveals a process of growth as time goes on. But the tempo of this growth does not remain uniform. The changes of this tempo, related to the basic tendency of the growth of creative productivity, thus constitute the wave-like fluctuations of the latter.

The existence of such more or less long waves in the tempo of the growth and in general changes of creative productivity in science may be foreseen, first at all, on the basis of certain general theoretical considerations.

In his recent mathematical work, devoted to the question of the origin of so-called quasi-periodic fluctuations by means of the addition of accidental causes, Professor E. E. SLUTZKY showed, among other things, the following (1).

Let us consider any empirically given series of values, the significances of which are, in each case, the results of « accidental » causes. And let us assume that, thanks to some temporary combination of these causes, between neighboring members of

(*) The calculations were made by O. V. GORDON and M. L. KOURASHEVA with the assistance of N. S. CHETVERIKOFF.

(1) E. SLUTSKY. a) The Summation of Random Causes as the Source of Cyclic Processes (Problems of Economic Conditions, 3, 1 Moscow, 1927 (Russ. with English summary). b) Sur un théorème limite relatif des quantités éventuelles (*Comptes Rendus*, t. 185, p. 169, 1927).

our series of consequences there exists a correlative connection, consisting, as is known, in the fact that the significance of each of the members depends upon the significance of others — upon the nearer members in greater degree than upon the more distant. E. E. SLUTZKY revealed that such series of correlatively connected consequences of accidental causes, developing, give a wave-like distribution of values. For example, in the beginning they gradually grow, then, just as gradually, they begin to decline, in order again to experience a more or less even increase, etc. and this notwithstanding the fact that the series on the whole may have any general tendency, permeating all its component parts and compelling the series to change in some definite direction.

These general considerations may easily be applied to the question under consideration. The yearly numbers of scientific discoveries, made in individual countries in any field of knowledge and measuring by their mass the exertion of creative activity in this field, really constitute a series of results, arising from the addition of accidental causes. Individual discoveries, as a rule, are the result of the activity of scientists, more or less independent of each other in their work and *in this sense* representing accidental factors of the discoveries. However these scientists are not altogether independent of each other. The interests which inspire some at a given time always in greater or less degree and for more or less long periods are shared with others. And hence the number of discoveries which they make from year to year also stand in a certain correlative relation one to another, the number of discoveries now grows from year to year, now more or less gradually diminishes, and these fluctuations may often take place about a rising line of growth of the general mass of discoveries, then representing variations in the tempo of this growth.

In the field which interests us here, in the field of history of physics, such wave-like fluctuations of the tempo of the growth of the number of discoveries are presupposed not only *a priori*, but are also as a result of empirical investigation. And, of course, inasmuch as these waverings may lay claim to historical reality, i.e. may be affixed to definite dates in time and in geographical space, their empirical establishment necessarily should play a firstclass, decisive role.

In the literature on the history of natural science, and especially of physics it has really already been pointed out that the creative activity of this or that country does not remain constant in time. For example, F. KLEIN (2) emphasized the long known fact that the end of the eighteenth century and the first decades of the nineteenth in France were a time of highest flourishing of physical-mathematical sciences. About 1830, according to his observation, this enlivenment was replaced by a relative decline. Here we have an indication of quite a long wave of creative activity. Also in France, according to the observation of FABRY (3), occurred another, similar wave. He noted, for instance, that the period of the Second Empire (1851-1870) in France was unfavorable for the development of such a leading sphere of physical science as thermodynamics. And only with the passing of this period began a more lively development of physical science in this sphere.

These and some other similar observations permit one to think that historical investigation could trace the fluctuations of creative productivity, at least in the sphere of physics. But since they possess the character of notes made en passant such observations, by themselves, cannot be recognized as sufficient for the actual establishment of the corresponding facts. And this all the more because it is a question of facts, mostly, of a quantitative nature. Affirming that the tempo of growth of creative activity in a given country and field of science experiences fluctuations in point of time we express a judgment about the fluctuations of a certain value. In order that such a judgment should possess sufficient definiteness it would be necessary to have the possibility somehow to measure this value and its variation. Up to this time this as it seems was not done in a sufficiently systematic form. And the very aim of the author of the present sketch was to obtain a quantitative measurement of the tempo of change of the number of discoveries in physics of modern times, in order in this way to ascertain the existence or non-existence of the above mentioned fluctuations of this tempo.

The method of investigation in this connection was self-in-

(2) F. KLEIN. *Vorlesungen über die Entwicklung der Mathematik im 19. Jahrhundert*, I, 1926, SS. 63 ff., 87-88.

(3) Ch. FABRY. *Histoire de la Physique* (*Histoire de la nation Française*, dirigée par HANOTAUX, t. 14, 1924, p. 329.

licated. It was necessary to give statistical expression to the mass of discoveries, made in physics from year to year, and then to subject the time series, which were to be obtained in this way, to a working over which might reveal the special qualities of these series.

However, all this presupposes that in general the problem of counting the number of discoveries in any fragment of time has a sense. But this is open to question.

The point is that a scientific discovery is something « ideal » — every discovery represents an idea of some content. « Ideas » in general do not possess a *material* existence. It is impermissible to ascribe the latter to them indirectly, either relating the scientific idea to that printed or other material cover, in the form of which the idea is published. It is impermissible — because, as could be demonstrated, several ideas can correspond to one and the same publication — and *vice versa*. We must here accept this thought without proofs. So we must count ideas, as such, *in all their immateriality*. Is this possible? We considered ourselves justified in replying to this question in the affirmative.

To count up any sort of class (aggregate, set) means to establish a correspondence between its individual members and those of the class of all the natural numbers. To establish such a correspondence it is indispensable that

1. The members of the counted class (aggregate, set), should possess features making it permissible to refer them *really* to this class.

2. The members of the counted class should be so definite that every one of them may be clearly distinguished from every other member of the same class.

Apparently the class (aggregate, set) of scientific discoveries, made anywhere at a given time satisfies both these elementary conditions. And, consequently, to each one of them it is possible to refer some one, and only one of the class of natural numbers, i.e. to assign a numero to every discovery. And this means to reckon up the number of discoveries.

In this connection we must not be confused by the fact that, reckoning up the number of discoveries, we take each discovery for a unit, whereas in reality discoveries are not of equal value. This cannot obstruct the reckoning because, *for the purpose of*

accounting, all discoveries are equally valuable — we are interested in them *only* because they are all *equally* discoveries and further because they are *different* discoveries. Similarly we count the population of any country, taking for the unit each of its inhabitants, regardless of differences of sex, age, social position, etc.

The question arises, what is the scientific value of such an account of the general mass of discoveries, without regard for the *different significance* of separate discoveries. Might it not turn out that two epochs, characterized, let us assume, by approximately the same number of discoveries in some unit of time, will differ very much according to the scientific *weight* of what was achieved in each of them?

This, of course, is possible, even though it has not been proved with sufficient strictness.

But let us grant that such proof can be and will be presented. Nevertheless this would not make superfluous the method of reckoning the general mass of discoveries which we propose. Its significance is comparable with the significance of a general account of the population in the economic and social life of some country. Of course it is desirable to differentiate our knowledge about it, dividing it into groups according to nationality, sex, age, class, property, etc., and demographic statistics are more or less successfully occupied with this. However, this does not make unnecessary a definition of the general mass of the population, i.e. the knowledge of how many human units enter into its make-up in one or another period. This is important not only because any demographic grouping already presupposes a knowledge of the general number of the population, but also because the number of the population is a factor which plays an independent role in the economic and general social life of every country.

In a similar way the reckoning of the general mass of scientific discoveries represents an independent interest in the examination of the creative activity of separate epochs. This reckoning makes us understand by what number of creative units these epochs are characterized. The individual discovery is just a creative unit, inasmuch as it indicates that corresponding creative work in general was achieved with some *success*. And success is the best measure of the productivity of creation. Therefore an account of successes, contained in scientific discoveries, is a

very important means for the determination of the average level of scientific creative productivity of the given epoch.

The nature of the statistical method which we used inevitably imposed on us the obligation to begin our investigation from the time for which the number of discoveries, defining the average level of creative productivity, becomes more or less considerable.

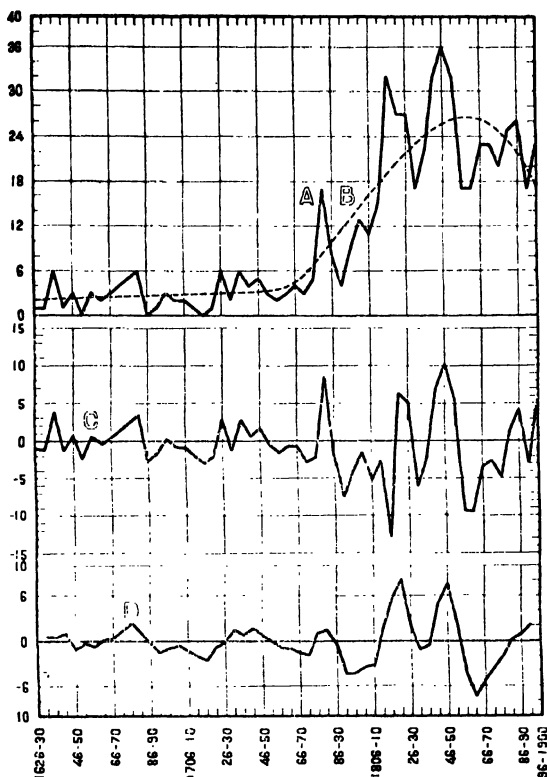
In the history of the development of physics, which was the special object of our investigation, such a time could be considered the period beginning approximately from the last decades of the eighteenth century. Earlier data in figures are so slight that their statistical value must be recognized as quite inconsiderable. Bearing this in mind, we nevertheless took the figures also of an earlier period, because, even with all their insufficiency, they could hint at interesting facts. Counting up the numbers of discoveries, in order to obtain larger figures, we took *not yearly but five-yearly sums of these*.

It was further necessary to decide how to reckon the number of discoveries according to the countries of the discoveries, or independently of these. For different considerations we chose the former method. Then we decided to limit ourselves only to three European countries — England, France and Germany. (We took as a territorial basis for the latter the territorial frontiers of 1870-1914).

In counting the number of physical discoveries in these countries we proceeded from F. AUERBACH's « *Geschichtstafeln der Physik* » (1910), which, as is known, were brought up to 1900. But because in this catalogue discoveries are not divided according to countries we ourselves carried out this division, being guided by data which it was possible to take from the capital bio-bibliographical encyclopedia of POGGENDORF, with its subsequent continuations. So we obtained a table of the number of physical discoveries, by five-year periods in the three above mentioned countries. (See in appendix Tables 1-3, first columns).

If we had represented these data graphically we would have reached the conviction that the dynamics of change of the number of physical discoveries *in all* three countries are characterized by *three* traits, common to them all. The upward curve of the movement of discoveries in France gives a plain indication of these. (See diagram No. 1).

FIG. 1.



First, the number of discoveries, from the beginning of the period taken up to 1900, reveals a more or less distinct *tendency* of change, characterizing the series *on the whole*. This tendency corresponds to what in the language of contemporary statistics is called *secular trend*.

Second, the tempo of change of the number of discoveries does not remain the same. Here accelerated, there delayed, by this very fact it gives fluctuations of more or less long duration about the line of secular trend, by which it would be possible to represent the general tendency of the mass of discoveries toward growth.

Third, these fluctuations, these waves, are uneven — they are interspersed with a series of zigzags.

What really interested us are the mentioned long temp fluctuations in the tempo of change of the number of discoveries. In order to examine them better it was necessary, so far as possible,

to separate them from that secular trend around which they were formed (in other words, to construct models of the waves). With this object the material for all three countries was subjected to working over, the course of which we show by the example of France (See for this Diagram No. 1 and Table No. 1).

First of all, by the method of the least squares, was carried out the line of the secular trend.

In the case of France, for which country the curve of original data of physical discoveries embraces the period from 1625-1630, the secular trend of change could not be represented by one smooth line. Therefore, in accordance with statistical practice (4), the curve of the original data was divided into two sectors, and the line of the secular trend was carried out for each of them independently. For the sector from 1625-1630 to 1760-1770 the course of secular trend could be more exactly represented by a straight line. To the more crooked course of the secular trend on the second sector (from 1760-1770 until 1900) best of all corresponds a certain parabola of the third order. With the mentioned main lines intersecting between 1760 and 1765 we obtain, as would seem, a single line of secular trend, about which, as is visible according to Diagram No. 1, proceed the long temp fluctuations in the tempo of change of the number of discoveries which we already noted.

In order to obtain the model of these fluctuations it is necessary, as is customarily done in statistics, to take the alternative deviations of the curve of the original data from the line of secular trend which has just been drawn. This operation is called the elimination of the secular trend. Being interested only in the configuration of these deviations, we can then relate them to the conditional straightline level, which we did on Diagram No. 1 (middle curve).

As we already noted, these long waves in the tempo of change of the number of discoveries are interspersed with smaller zigzags. Possessing independent interest, the zigzags obscure the configuration of the long waves which are now occupying us. We can free ourselves from the zigzags by subjecting the just obtained deviations of the curve of the original data of the number of discoveries from the line of the secular trend to the so-called moving average method (by three dots). As a result

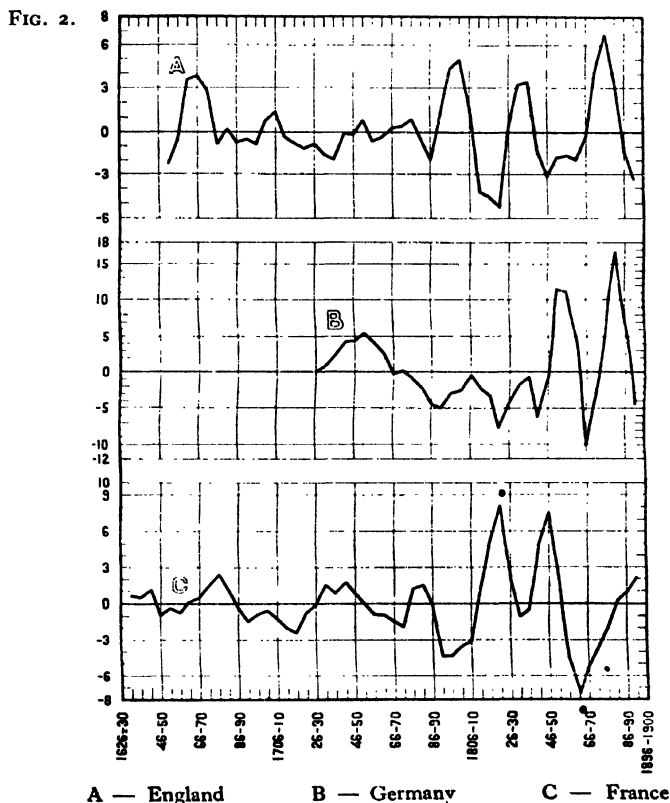
(4) See MILLS. *Statistical Methods*. 1924. p. 306.

we have the pure contours of the curves which interest us (lower curve on diagram No. 1). Of course this is only a model, the real significance of which must be appraised by glancing at the issuing upper curve of the original data of five-year sums of physical discoveries. And it is not difficult to see that our model adequately corresponds to the mentioned curve.

Because of lack of space we cannot represent graphically all the stages of the analogous working over of the original data of physical discoveries in England and Germany.

We shall only note that the line of the secular trend of changes of this series for England (from 1645 until 1900) is made up by putting together a straight line for the period from 1645 until 1790-1800 and a parabola of the third order (for the remaining part of the series). After the elimination of the secular trend the model of long waves in the tempo of change of the number of physical discoveries in England, in its final form, is presented on Diagram No. 2 (Table No. 2).

As concerns Germany (series of five-year sums of discoveries



from 1600-1605 until 1900), for the expression of the secular trend of the number of physical discoveries we succeeded in working one curve (See table No. 3).

Excluding this secular trend we obtained a model of the long waves of creative productivity in German physics. On Diagram No. 2 this model is presented for the period of time from 1726-30, when, in accordance with the growing fullness of material, the waves become sufficiently distinct.

Using our diagrams we can affirm that in the tempo of change of the number of physical discoveries in England, France and Germany there took place (up to 1900) long temp fluctuations, each one of some decades. The intensity of creative activity of scientists in the realm of physics alternatively strengthened and weakened in each of these countries.

Such is the result of the statistical working over of material, taken from the tables of AUERBACH. It was necessary to put the question, what was the historical reliability of this account.

The answer depended upon the degree of historical completeness of the basic tables of AUERBACH.

In this respect we had a number of well-founded doubts. Having no possibility to explain them here we must limit ourselves to the statement that in order to remove them we found it necessary to check upon the data of AUERBACH's tables with the aid of other data, mostly obtained *independently* of AUERBACH's tables. With this end we undertook the compilation of other and possibly *fuller* tables.

Here we followed the example of AUERBACH. In making up his tables he used as his main source the collection of physical discoveries in WINCKELMANN's « Handbuch der Physik », the encyclopedia of POGGENDORFF, and various histories of physics (ROSENBERGER, HELLER, partially also the book of DARMSTÄDTER.)

At the base of our tables of physical discoveries we, like AUERBACH, placed an authoritative physical compendium, « The Course of Physics », by O. D. KHVOLSON (Vols. I-V). Less detailed than the collection of WINCKELMANN, the work of KHVOLSON, by general recognition, is distinguished by remarkable factual completeness and impartiality in its references to discoveries made in all countries. This high appraisal is also confirmed by the fact of its translation into the German and French languages.

However, not being, like the « Handbuch » of WINCKELMANN,

actually an historical work, the « Course » of KHVOLSON contains references, mostly to discoveries made since the middle of the nineteenth century. The earlier period is poorly represented in his work. Therefore — once again according to the example of the AUERBACH — it was necessary to cite actual historical sources in order to compile chronological tables of discoveries. Among these we first of all went into the latest « Geschichte der Physik » (1926), by E. HOPPE, which is especially convenient because it constitutes an unusually complete and systematic summary of scientific discoveries, divided in chronological order according to the basic departments and problems of physics. Besides, this we also used two books by MACH — « Principien d. Wärmelehre » (1923), and « Principien d. physikalischen Optik » (1921). Finally, *after the compilation* of tables on the basis of all the mentioned sources, we compared them with the tables of AUERBACH, taking over from the latter into our tables what little was to be found *only* in AUERBACH. For several reasons we limited our tables to the period from 1771 until 1900. Besides, we intentionally included in them *only* discoveries in the sphere of physics — *heat, light, electricity* and *magnetism*.

As a result of all this the data of our tables for the mentioned period were numerically richer than those of AUERBACH for the same period, notwithstanding the fact that the latter embrace *all* departments of physics. The relation between our tables and those of AUERBACH is illustrated by the following data :

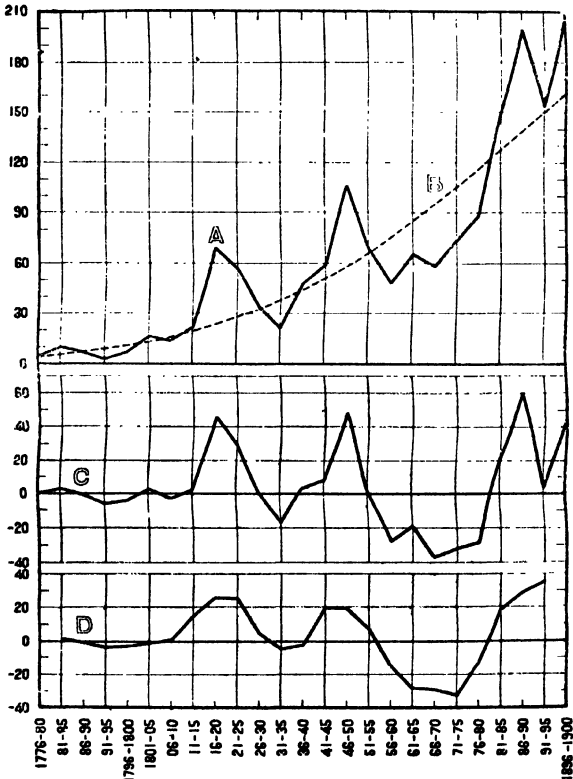
NUMBER OF DISCOVERIES FROM 1771-1900

Country	Our tables	Auerbach's tables	Relation of number of discoveries in our tables to number in Auerbach's tables, in percentages.
France	1592	502	317
England	1405	566	250
Germany	2863	1273	225
Sum	5860	2341	250

Such a sharp difference in the details of AUERBACH's tables and of our permit us to think that, if the waves of creative activity which we revealed according to the data of AUERBACH should also be confirmed by our own data, then these waves must possess historical reality.

The statistical data, obtained on the basis of an account of the number of discoveries, *according to five-year periods* in our tables, were subjected to the same working over as those data which were taken from the tables of AUERBACH. For example, the working over for France went thus. Placing on a curve the original data of five-year sums of physical discoveries, we became convinced that this series clearly points to the existence of long fluctuations in the tempo of change of the number of discoveries. In order to construct the model of these waves through the series first was drawn a line of secular trend. It was a sort of exponential curve. Then the deviations of the original data from it were taken. Smoothing them according to the moving-average method (by three dots) we got the model of long temp fluctuations or of long waves in the tempo of changes of the number of physical discoveries in France. All stages of the working over of materials for this country are represented graphically on Diagram No. 3 and in Table No. 4.

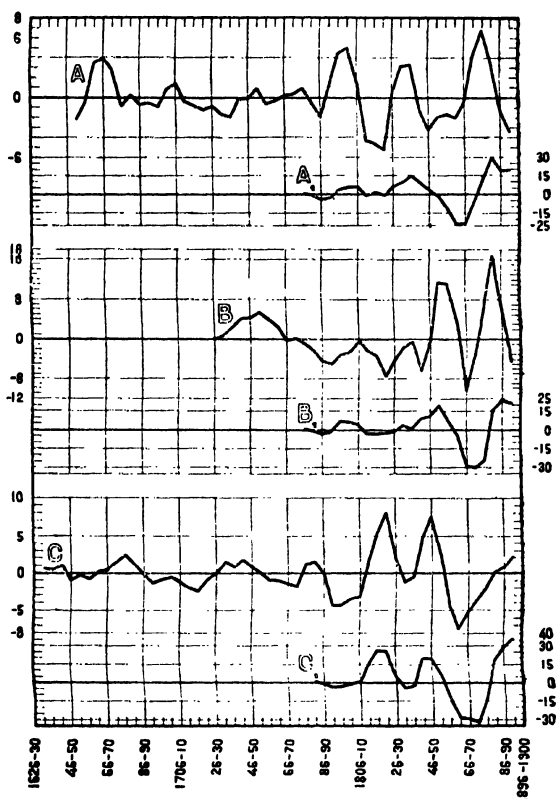
FIG. 3. 210



A — Original data. B — Secular trend. C — Deviations from the fitted curve. D — Deviations averaged by 3.

The data for England and Germany were also subjected to an analogous working over. Without citing here all the stages of this working over (See Tables No. 5 and 6) we confine ourselves to the communication of its results — the models of long temp fluctuations of creative activity in the physics of England and France. In Diagram No. 4 they are placed in comparison with corresponding curves, constructed according to the data of the tables of AUERBACH.

FIG. 4.



A — England (AUERBACH's Tables). B — Germany (AUERBACH's Tables).
 A_1 " (Author's "). B_1 " (Author's ").
 C — France (AUERBACH's Tables).
 C_1 " (Author's ").

From this comparison it is easy to see that the waves which it is possible to reveal according to the tables of AUERBACH in substance are *fully confirmed by the data drawn from our own*

tables. And because these latter are more detailed than the tables of AUERBACH by two or three times and more, it is impossible to think that the dynamic of discoveries according to our tables simply reproduces the dynamic, resulting from the tables of AUERBACH. Long fluctuations of creative activity in recent European physics exist, apparently, historically, and not only statistically (in our tables). Further on we will form judgments about these fluctuations, basing ourselves on the graphic results of the working over of the data of our detailed tables.

Not having the possibility to go into a description of the forms and successivenesses of waves in separate countries we confine ourselves to some general observations :

1. We can state that long waves of creative productivity in every country have periods of some decades.

2. These waves are not periodic in the strict sense of the word. However, they all possess a cyclical character, by which we mean a reproduction by successive waves of single-type stages of rise and fall of activity in more or less different intervals of time.

3. In comparing waves in separate countries it may be noted that the waves of creative productivity in German and English physics are quite synchronized (See Diagram No. 4).

4. There is no such complete synchronism between the waves in Germany and England, on one side, and in France, on the other. The period from 1830 to 1900 has much the same characteristics in France as in Germany and England. But if we go further back we do not note such a correspondence.

5. This disturbance of synchronism is easily explained if one takes into consideration that in France in the last quarter of the eighteenth and the first quarter of the nineteenth century all cultural life was under the strong influence of the Great Revolution and its consequences. But here we have no possibility to enter into a consideration of this question and must confine ourselves merely to general observations.

We note by the way, that the confirmation of AUERBACH's data by our more detailed data for the period 1771-1900 compels us to accord a certain amount of confidence to his data also beyond the limits of this stretch of time, in the seventeenth and eighteenth centuries. Long waves, apparently, existed in European physics

also then, but evidently bore a different character from that which prevailed later.

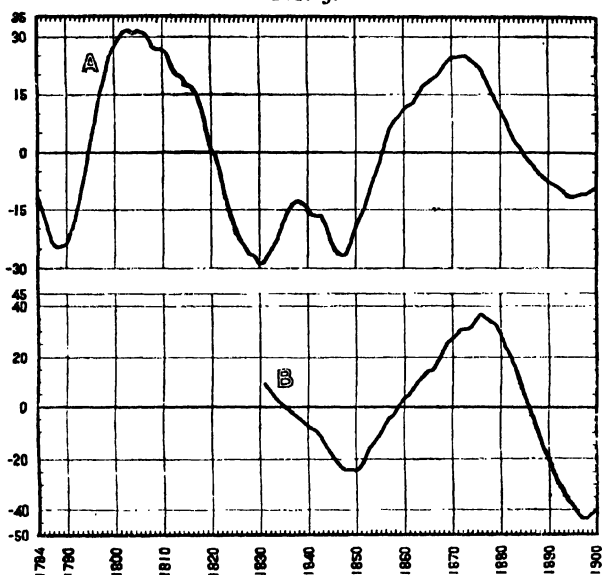
Compelled by insufficiency of space to break off here the exposition of our observations on the prolonged waves from 1771 until 1900, we shall complete, in conclusion, with one very important remark. This is that the waves which we revealed in the tempo of change of the number of physical discoveries are phenomena, which are connected with other phenomena in the social history of that time.

In the economic literature of the last decades has been established the existence of long waves in the *economic* dynamics of all the main West-European countries (5). Disputes still go on regarding the question in which countries or elements of economic life these waves are reflected. It is generally recognized that they exist, in any event, in the 19 cent, in the movement of the general price-level and of prices of coal, wheat, cotton and other individual goods. The same waves are firmly established in the dynamics of trade turnover (as expressed in money), in the movement of interest rate, nominal wages, in the price of bonds etc. — in brief, in the movement of the so-called value indices of economic dynamics. In all these spheres long waves represent long temp fluctuations in the tempo of change of prices, wages, trade, turnover, etc.

(5) See STANLEY JEVONS. 'The variation of price and the value of currency since 1782 (*Journal of the Statistical Society*, 1865). WICKSELL. Geldzins und Güterpreise. 1896 (SS. 150-162.) PARVUS. Handelskrisis und Gewerkschaften. 1896. KAUTSKY. a) Krisentheorien (*Neue Zeit*, 2, 1902). b) Gold, Papier und Ware (*Neue Zeit*, XXX, 1, 1912. AFTALION. Les crises périodiques de surproduction, 1, 1913; préface. LENOIR. Etudes sur la formation et le mouvement des prix. 1913. MOORE. Generating economic cycles 1923 (chap. 3.). MILDSCUH. Kreditinflation und Geldtheorie. (*Archiv für Sozialwissenschaft und Sozialpolitik*, 1924, Bd. 52, Hft I). DE WOLFF. Prosperitäts- und Depressionsperioden (Festgabe f. K. KAUTSKY: Der Lebendige Marxismus, 1924). KONDRATIEFF. a) Die langen Wellen der Konjunktur (*Archiv f. Sozialwissenschaft u. Sozialpolitik*, Bd. 56, Heft 3, 1926). b) K-FF and OPARIN, Bolshije cicly conjuncturi (russ.) 1928. c) K-FF. Die Preisdynamik d. industriellen und landwirtschaftlichen Waren (*Archiv f. Sozialpolitik*, Bd. 60, H. 1, 1928, SS. 31 ff.) SPIETHOFF. Krisen (*Handwoerterbuch d. Staatswissenschaften*, 4. Aufl., Bd. VI, 1925). GUBERMAN. Problemi bolsich i malich ciclow (*Sozialisticheskoje Chosjaistwo*, 1927, 1, russ.) BASAROW. Capitalisticheskije cicli... 1927 (russ.). PIETRI-TONNELLI. Traité d'économie rationnelle 1927 (Chap. VI). MITCHELL. Business cycles. 1927. HÄRZENSTEIN. Sushchestwujut il bolshije cicly conjuncturi 1928 (criticism of KONDRATIEFF).

Furthermore it is possible to be convinced that between the long waves of creative productivity which we revealed and the just mentioned waves in economic life exists an undoubted and easily traced connection.

FIG. 5.



On Diagram No. 5 (6) the upper curve A represents the model of the long waves in the movement of the general price-index in England. It is created by the same methods as our curves. We further note that it is *typical* for long waves in a *whole series* of value indices of British economic life. Comparing this curve with the curve of long waves in English physics according to the data of our detailed tables, we establish the following facts:

1. The long waves in the movement of the general price level and in general of a whole series of value indices of British economic life from 1780 until the end of the nineteenth century took place, generally speaking, in correspondence with the long temp fluctuations of creative productivity in English physics of the same period.
2. This correspondence bore now a direct, now an inverted character.

3. Between 1780 and 1830 this correspondence, for the most part, bore a direct character. Between 1830 and 1900 it became predominantly inverted.

Turning to France we first cite the diagram of long waves in the turnover of foreign trade, *characteristic* for the movement of its main value indices (See Diagram No. 5, curve B): this is the most long and uninterrupted series at the disposal of contemporary statistics of French economic life, but even this is short, beginning only from the thirties of the nineteenth century.

From the comparison of this curve with our curve of long waves in French physics (See Diagram No. 4) emerge the following facts:

1. The long waves in the foreign trade of France from the thirties of the nineteenth century, and also a number of other economic indices are in correspondence with the long waves of creative productivity in physics.

2. This correspondence bears an almost exclusively inverted character.

For Germany general imperial statistics begin only from the seventies, and up to this time there is only a series of substitute of general German economic indices. On the basis of these it is established that the tempo of growth of German prices from 1843 until 1873 is characterized by a rising tendency, while from 1874 until 1894 a reverse tendency manifested itself.

Comparing these data with our curve of creative productivity in German physics (Diagram No. 4) we note that also here:

1. Between long waves in the development of physics and the same waves in the movement of prices there was, in general, correspondence.

2. This correspondence for the mentioned period bore an inverted character.

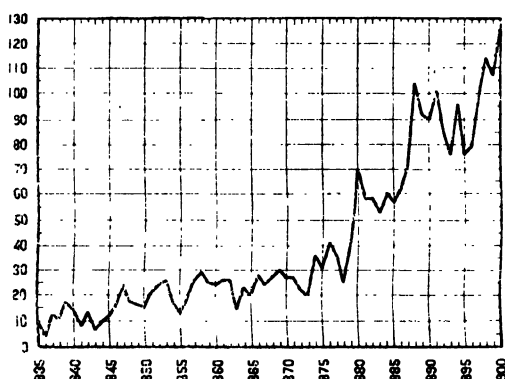
We possess a series of statistical and qualitative data which would permit us to make at least some preliminary explanation of the mentioned correspondence between long waves in the development of West-European physics and economic life. But from insufficiency of space we are deprived of the possibility to reproduce here and analyze all these data.

Breaking off here our considerations in regard to long waves of creative productivity in the history of physics, we shall further briefly touch on the question of the « short waves ».

We know that curves of the original data of the number of physical discoveries for separate countries are characterized by three traits. First a *secular* trend belongs to the series on the whole. Second, about the line which expresses this tendency rise and fall the *long waves* which we revealed in the tempo of the change of discoveries. Finally, these waves (*until they are smoothed out by the moving average method*) are interspersed with a series of zigzags.

Hitherto we have stood aside from these zigzags. It is possible, however, to attempt to explain whether they as well represent a development of a wave-like character. In order to reveal this it was necessary to have at our disposal a series of discoveries not by five-year but by annual periods. Our detailed tables gave us such a series (see Appendix). It was necessary to confine ourselves to the period of time, beginning with the thirties of the nineteenth century and even later, because up to that time yearly figures of discoveries were too few for purposes of statistical investigation.

FIG. 6.

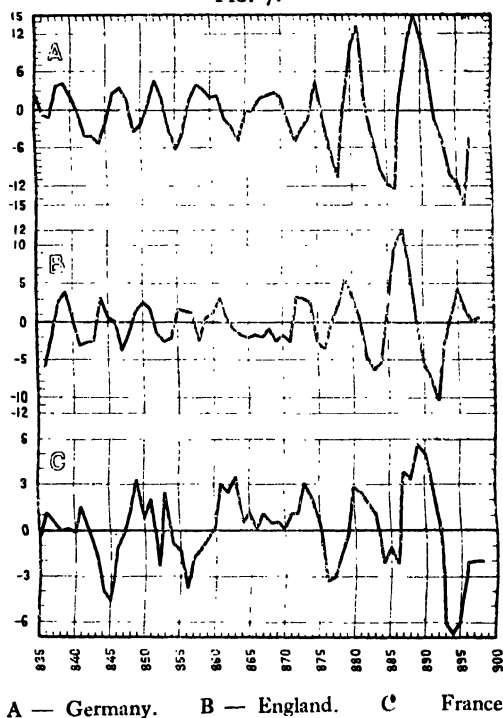


Curve No. 6 represents the yearly course of the number of physical discoveries in Germany. In it is clearly perceptible a secular trend toward growth. After this are visible long fluctuations in the tempo of growth, which we have already examined above (See above Diagram No. 4). Finally the zigzags on the long waves strike one's eye. These are zigzags of different orders. The largest of them as it clearly stands out, represent wavelike formations, each one of a length of *some years*. It is these which now interest us.

Lacking space, we cannot cite data about the stages of working over of material (7), permitting us to construct the model of these small waves. The substance of the method used here comes to this, that with the help of the method of the least squares and the moving average method, we carried out for the rough series of yearly numbers of discoveries of the line of secular trend, then, excluding this trend, we obtained long waves; immediately after the elimination of the latter, there remained only short waves, interspersed with small zigzags, which were removed by the application of the moving average (See table No. 7).

In such manner were constructed the models of short waves for our three countries, represented on Diagram No. 7 (See tables Nos. 8 and 9).

FIG. 7.



The length of the waves varies between 5-9 years (reckoning from maximum to minimum), but on the average is equal to seven or eight years.

It is not only in changes of creative productivity in the sphere of physics that waves of this kind exist. They are long and well known in economics.

We note that for a « wave » we conditionally take in the history of physics, here and above, the distance from minimum to minimum. And just so in economics we reckoned for one wave the total of the processes of change in the tempo of economic life from depression to depression, i.e. from one minimum to another.

The comparison below shows that for England, for example, between short waves in the development of physics and in the development of economic life exists a sufficiently satisfactory *synchronism* and *direct* correspondence.

ENGLAND (Short waves).

<i>Physics.</i>	<i>Economic Life (8)</i>
Years.	Years.
1. 1836-1841	1. 1833-42
2. 1842-47	2. 1843-49
3. 1848-53	3. 1849-55
4. 1854-58 (59?)	4. 1856-58
5. 1859-69	5. 1859-68
6. 1870-76	6. 1869-79
7. 1877-83	7. 1879-86
8. 1884-92	8. 1886-95

We do not cite data for the same correspondence for Germany and France. According to the condition of our information about short waves in the economic life of these countries correspondence here could be revealed only with the aid of certain explanations and analyses, which lack of space prevents us from citing. However, there is no doubt regarding the existence of the mentioned correspondence also in these countries.

We wish to observe that we do not possess sufficient data for

(8) See MITCHELL. *Business cycles*. 1927, and THORP. *Business annals*. 1926 (chap. 11).

the *explanation* of this correspondence and state it as a fact which still needs illumination.

The long and short waves which we revealed in the tempo of changes in the creative productivity of West-European physics will obtain full illumination only if we do succeed in finding them also in the development of other kindred sciences (especially chemistry) and in showing their relation to the evolution of technique. The author continues his work in this direction.

1928. November. Moscow.

T. J. RAINOFF.

Table Nr. 1.

FRANCE.

NUMBER OF PHYSICAL DISCOVERIES (5-YEARLY SUMS).

(TABLES OF AUERBACH).

Years	Original data	Fitted data	Deviations from the fitted data	Deviations averaged by 3	Years	Original data	Fitted data	Deviations from the fitted data	Deviations averaged by 3
1626-30	1	2,04	-1,0		66-70	4	4,66	-0,7	-1,4
31-35	1	2,09	-1,1	0,6	71-75	3	5,79	-2,8	-1,9
36-40	6	2,15	3,8	0,5	76-80	5	7,05	-2,1	1,2
41-45	1	2,20	-1,2	1,1	81-85	17	8,42	8,6	1,5
46-50	3	2,25	0,7	-0,9	86-90	8	9,88	-1,9	-0,2
51-55	0	2,31	-2,3	-0,3	91-95	4	11,40	-7,4	-4,4
56-60	3	2,36	0,6	-0,7	96-1800	9	12,96	-4,0	-4,3
61-65	2	2,41	-0,4	0,2	1801-05	13	14,54	-1,5	-3,5
66-70	3	2,47	0,5	0,5	06-10	11	16,12	-5,1	-3,1
71-75	4	2,52	1,5	1,5	11-15	15	17,66	-2,7	1,7
76-80	5	2,57	2,4	2,4	16-20	32	19,16	12,8	5,5
81-85	6	2,63	3,4	1,0	21-25	27	20,58	6,4	8,1
86-90	0	2,68	-2,7	-0,3	26-30	27	21,91	5,1	1,8
91-95	1	2,73	-1,7	-1,4	31-35	17	23,11	-6,1	-1,1
96-1700	3	2,79	0,2	-0,8	36-40	22	24,18	-2,2	-0,5
1701-05	2	2,84	-0,8	-0,5	41-45	32	25,07	6,9	5,0
06-10	2	2,89	-0,9	-1,2	46-50	36	25,78	10,2	7,6
11-15	1	2,95	-2,0	-2,0	51-55	32	26,28	5,7	2,1
16-20	0	3,00	-3,0	-2,4	56-60	17	26,54	-9,5	-4,5
21-25	1	3,05	-2,1	-0,7	61-65	17	26,55	-9,6	-7,5
26-30	6	3,10	2,9	-0,1	66-70	23	26,28	-3,3	-5,2
31-35	2	3,16	-1,2	1,5	71-75	23	25,70	-2,7	-3,6
36-40	6	3,21	2,8	0,8	76-80	20	24,79	-4,8	-2,0
41-45	4	3,26	0,7	1,7	81-85	25	23,54	1,5	0,3
46-50	5	3,32	1,7	0,7	86-90	26	21,92	4,1	0,9
51-55	3	3,37	-0,4	0,0	91-95	17	19,90	-2,9	2,2
56-60	2	3,42	-1,4	-0,8	96-1900	23	17,46	5,5	
61-65	3	3,68	-0,7	-0,9					

Secular trend for the period from 1626-1630 to 1776-80 :

$$y = 2,8387 + 0,0532 x.$$

Secular trend for the period from 1746-50 to 1896-1900 :

$$y = 20,581641 + 1,37773659 x - 0,048399709 x^2 - 0,003821214 x^3.$$

Table Nr. 2.

ENGLAND.

NUMBER OF PHYSICAL DISCOVERIES (5-YEARLY SUMS).

(TABLES OF AUERBACH).

Years.	Original data	Fitted data	Deviations from the fitted data	Deviations averaged by 3	Years	Original data	Fitted data	Deviations from the fitted data	Deviations averaged by 3
1646-50	0	2,90	-2,9		76-80	5	4,89	0,1	0,9
51-55	0	2,96	-3,0	-2,3	81-85	6	5,78	0,2	-0,5
56-60	2	3,02	-1,0	-0,4	86-90	5	6,93	-1,9	-2,0
61-65	6	3,08	2,9	3,6	91-95	4	8,30	-4,3	1,0
66-70	12	3,15	8,8	3,8	96-1800	19	9,85	9,1	4,4
71-75	3	3,21	-0,2	2,8	1801-05	20	11,56	8,4	5,0
76-80	3	3,27	-0,3	-0,9	06-10	11	13,38	-2,4	1,6
81-85	1	3,33	-2,3	0,3	11-15	14	15,30	-1,3	-4,3
86-90	7	3,40	3,6	-0,7	16-20	8	17,26	-9,3	-4,6
91-95	0	3,46	-3,5	-0,5	21-25	16	19,24	-3,2	-5,2
96-1700	2	3,52	-1,5	-0,9	26-30	18	21,20	-3,2	0,5
01-05	6	3,58	2,4	0,8	31-35	31	23,12	7,9	3,2
06-10	5	3,64	1,4	1,4	36-40	30	24,96	5,0	3,4
11-15	4	3,71	0,3	-0,4	41-45	24	26,68	-2,7	-1,3
16-20	1	3,77	-2,8	-0,8	46-50	22	28,25	-6,3	-3,2
21-25	4	3,83	0,2	-1,2	51-55	29	29,64	-0,6	-1,9
26-30	3	3,89	-0,9	-0,9	56-60	32	30,82	1,2	-1,7
31-35	2	3,96	-2,0	-1,6	61-65	26	31,74	-5,7	-2,0
36-40	2	4,02	-2,0	-2,0	66-70	31	32,39	-1,4	-0,3
41-45	2	4,08	-2,1	-0,1	71-75	39	32,71	6,3	4,1
46-50	8	4,14	3,9	-0,1	76-80	40	32,69	7,3	6,8
51-55	2	4,20	-2,2	0,8	81-85	39	32,29	6,7	3,5
56-60	5	4,27	0,7	0,6	86-90	28	31,46	-3,5	-1,3
61-65	4	4,33	-0,3	-0,3	91-95	23	30,19	-7,2	-3,4
56-70	3	4,39	-1,4	0,3	96-1900	29	28,44	0,6	
71-75	7	4,45	2,5	0,4					

Secular trend for the period from 1646-50 to 1791-95 :

$$y = 3,800 + 0,0311x.$$

Secular trend for the period from 1746-50 to 1895-1900

$$y = 19,238736 + 1,979249529x - 0,007419856x^2 - 0,005575811x^3.$$

GERMANY.

NUMBER OF PHYSICAL DISCOVERIES (5-YEARLY SUMS).

(TABLES OF AUERBACH).

Years	Original data	Fitted data	Deviations from the fitted data	Deviations averaged by 3
1721-25	0	0,2	-0,2	
26-30	1	0,3	0,7	0,0
31-35	0	0,4	-0,4	0,9
36-40	3	0,5	2,5	2,4
41-45	6	0,8	5,2	4,2
46-50	6	1,0	5,0	4,3
51-55	4	1,3	2,7	5,4
56-60	10	1,6	8,4	4,1
61-65	3	1,8	1,2	2,7
66-70	1	2,5	-1,5	-0,2
71-75	3	3,2	-0,2	0,1
76-80	6	3,9	2,1	-0,9
81-85	0	4,6	-4,6	-2,3
86-90	1	5,3	-4,3	-4,5
91-95	2	6,7	-4,7	-5,0
96-1800	2	8,0	-6,0	-3,0
1801-05	11	9,4	1,6	-2,6
06-10	8	11,3	-3,3	-0,4
11-15	14	13,5	0,5	-2,3
16-20	12	16,2	-4,2	-3,3
21-25	13	19,2	-6,2	-7,7
26-30	10	22,6	-12,6	-4,2
31-35	33	26,8	6,2	-1,6
36-40	33	31,5	1,5	-0,7
41-45	27	36,9	-9,9	-6,2
46-50	33	43,1	-10,1	-0,7
51-55	68	50,2	17,8	11,5
56-60	85	58,2	26,8	11,1
61-65	56	67,4	-11,4	3,8
66-70	74	77,9	-3,9	-10,3
71-75	74	89,7	-15,7	-2,9
76-80	114	103,1	10,9	6,3
81-85	142	118,2	23,8	16,8
86-90	151	135,3	15,7	6,7
91-95	135	154,4	-19,4	-4,5
96-1900	166	175,8	-9,8	

Table Nr. 4.

FRANCE.

NUMBER OF PHYSICAL DISCOVERIES (5-YEARLY SUMS). HEAT, LIGHT,
ELECTRICITY, AND MAGNETISM.
(AUTHOR'S TABLES) I.

Years	Original data	Fitted data	Deviations from the fitted curve	Deviations averaged by 3
1776-80	5	4,7	0,3	
81-85	10	5,9	4,1	1,4
86-90	7	7,3	-0,3	-0,7
91-95	3	9,0	-6,0	-3,5
96-00	7	11,1	-4,1	-2,5
1801-05	16	13,5	2,5	-1,3
06-10	14	16,3	-2,3	0,9
11-15	22	19,6	2,4	15,2
16-20	69	23,4	45,6	25,8
21-25	57	27,7	29,3	25,4
26-30	34	32,7	1,3	4,5
31-35	21	38,2	-17,2	-4,1
36-40	48	44,4	3,6	-2,0
41-45	59	51,3	7,7	19,8
46-50	107	58,8	48,2	19,3
51-55	69	67,0	2,0	7,5
56-60	48	75,8	-27,8	-15,0
61-65	66	85,3	-19,3	-28,1
66-70	58	95,2	-37,2	-29,4
71-75	74	105,7	-31,7	-32,5
76-80	88	116,5	-28,5	-12,6
81-85	150	127,6	22,4	18,0
86-90	199	138,9	60,1	28,8
91-95	154	150,1	3,9	36,3
96-1900	206	161,1	44,9	

$$y = 10^{f(x)}; f(x) = 1,647302 + 0,063846173 x - 0,0014327009 x^2.$$

Table Nr. 5.

ENGLAND.

NUMBER OF PHYSICAL DISCOVERIES (5-YEARLY SUMS). HEAT, LIGHT,
ELECTRICITY, AND MAGNETISM.

(AUTHOR'S TABLES).

Years	Original data	Fitted data	Deviations from the fitted curve	Deviations averaged by 3
1771-75	11	10,0	1,0	
76-80	17	10,8	6,2	0,8
81-85	7	11,7	-4,7	-0,8
86-90	9	12,8	-3,8	-4,5
91-95	9	13,9	-4,9	-2,3
96-00	17	15,2	1,8	4,0
1801-05	32	16,7	15,2	5,2
06-10	17	18,3	-1,3	5,2
11-15	22	20,2	1,8	-1,6
16-20	17	22,4	-5,4	1,2
21-25	32	24,8	7,2	-1,3
26-30	22	27,7	-5,7	6,2
31-35	48	30,9	17,1	9,3
36-40	51	34,6	16,4	14,2
41-45	48	38,9	9,1	8,9
46-50	45	43,9	1,1	2,9
51-55	48	49,6	-1,6	-1,9
56-60	51	56,3	-5,3	-11,6
61-65	36	64,0	-28,0	-24,5
66-70	33	73,1	-40,1	-23,3
71-75	82	83,7	-1,7	-6,0
76-80	120	96,1	23,9	11, 8
81-85	124	110,7	13,3	29,8
86-90	180	127,9	52,1	19,4
91-95	141	148,3	-7,3	19,5
96-00	186	172,4	13,6	

$$y = 10^{(12)}; f(x) = 1,5144727 + 0,02470125 x + 0,00016730082 x^2.$$

Table Nr. 6.

GERMANY.

NUMBER OF PHYSICAL DISCOVERIES (5-YEARLY SUMS). HEAT, LIGHT,
ELECTRICITY, AND MAGNETISM.

(AUTHOR'S TABLES)

Years	Original data	Fitted data	Deviations from the fitted curve	Deviations averaged by 3
1771-75	3	3,1	-0,1	
76-80	11	3,8	7,2	1,2
81-85	1	4,6	-3,6	-0,7
86-90	0	5,7	-5,7	-3,1
91-95	7	7,0	0,0	-0,1
96-00	14	8,6	5,4	6,9
1801-05	26	10,6	15,4	6,3
06-10	11	13,0	-2,0	4,2
11-15	15	15,9	-0,9	-3,5
16-20	12	19,6	-7,6	-3,5
21-25	22	24,1	-2,1	-2,4
26-30	32	29,6	2,4	-1,4
31-35	32	36,4	-4,4	3,8
36-40	58	44,7	13,3	1,3
41-45	50	54,9	-4,9	9,6
46-50	88	67,5	20,5	11,2
51-55	101	82,9	18,1	19,6
56-60	122	101,9	20,1	7,3
61-65	109	125,2	-16,2	-4,7
66-70	136	153,9	-17,9	-29,1
71-75	136	189,2	-53,2	-30,2
76-80	213	232,5	-19,5	-24,2
81-85	286	285,8	0,2	16,2
86-90	419	351,2	67,8	23,5
91-95	443	431,6	• 2,4	21,6
96-1900	525	530,4	-5,4	

$$y = 10^{f(x)}; f(x) = 1,605306 + 0,044773 x.$$

Table Nr. 7.

GERMANY

NUMBER OF PHYSICAL DISCOVERIES (YEARLY SUMS). HEAT, LIGHT
ELECTRICITY, AND MAGNETISM.

(AUTHOR'S TABLES)

Years	Original data	Fitted data	Deviations from the fitted data	Long waves	Deviations from the long waves	Short waves
1835	10	7,9	2,1	0,6	1,5	-2,5
36	4	8,2	-4,2	1,0	-5,2	-0,8
37	12	8,6	3,4	1,4	2,0	-1,2
38	11	8,9	2,1	1,5	0,6	3,9
39	17	9,3	7,7	1,5	6,2	4,3
1840	14	9,7	4,3	1,5	2,8	2,2
41	8	10,1	-2,1	1,8	-3,9	-0,3
42	13	10,5	2,5	1,9	0,6	-4,2
43	7	11,0	-4,0	2,1	-6,1	-4,2
44	10	11,4	-1,4	2,3	-3,7	-5,4
1845	12	11,9	0,1	2,4	-2,3	-2,2
46	16	12,4	3,6	2,7	0,9	2,6
47	24	13,0	11,0	3,5	7,5	3,5
48	17	13,5	3,5	4,2	-0,7	1,8
49	16	14,1	1,9	4,6	-2,7	-3,5
1850	15	14,7	0,3	4,6	-4,3	-2,5
51	21	15,3	5,7	4,5	1,2	0,4
52	24	15,9	8,1	4,2	3,9	4,7
53	26	16,6	9,4	4,1	5,3	2,2
54	17	17,3	-0,3	3,9	-4,2	-2,8
1855	13	18,0	-5,0	4,0	-9,0	-6,4
56	18	18,8	-0,8	3,9	-4,6	-3,8
57	26	19,6	6,4	3,3	3,1	1,6
58	29	20,4	8,6	2,6	6,0	4,0
59	25	21,2	3,8	1,9	1,9	3,1
1860	24	22,1	1,9	1,1	0,8	1,9
61	26	23,1	2,9	0,1	2,8	2,3
62	26	24,0	2,0	-0,6	2,6	-1,4
63	14	25,0	-11,0	-1,6	-9,4	-2,7
64	23	26,1	-3,1	-2,5	-0,6	-5,0
1865	20	27,2	-7,2	-3,4	-3,8	-0,2
66	28	28,4	-0,4	-4,1	3,7	-0,1

Table Nr. 7 (cont.).

Years	Original data	Fitted data	Deviations from the fitted data	Long waves	Deviations from the long waves	Short waves
1867	24	29,5	-5,5	-5,2	-0,3	1,9
68	27	30,8	-3,8	-5,9	2,1	2,3
69	30	32,1	-2,1	-6,7	4,6	2,8
1870	27	33,4	-6,4	-7,4	1,0	2,1
71	27	34,8	-7,8	-7,9	0,1	-1,6
72	22	36,3	-14,3	-8,6	-5,7	-5,1
73	20	37,8	-17,8	-9,3	-8,5	-3,0
74	36	39,4	-3,4	-9,2	5,8	-1,5
1875	31	41,1	-10,1	-8,7	-1,4	4,5
76	41	42,8	-1,8	-7,5	5,7	-0,8
77	36	44,6	-8,6	-6,0	-2,6	-6,4
78	25	46,5	-21,5	-4,1	-16,4	-10,8
79	41	48,5	-7,5	-3,1	-4,4	0,1
1880	70	50,5	19,5	-2,2	21,7	10,2
81	58	52,6	5,4	-1,4	6,8	13,2
82	58	54,8	3,2	0,6	2,6	1,2
83	53	57,2	-4,2	2,4	-6,6	-3,4
84	60	59,6	0,4	4,4	-4,0	-9,5
1885	57	62,1	-5,1	6,9	-12,0	-11,7
86	62	64,7	-2,7	8,8	-11,5	-12,5
87	71	67,4	3,6	9,4	-5,8	2,5
88	104	70,2	33,8	10,4	23,4	10,9
89	92	73,2	18,8	10,6	8,2	15,0
1890	90	76,3	13,7	9,8	3,9	10,9
91	101	79,5	21,5	7,9	13,6	5,9
92	85	82,8	2,2	5,8	-3,6	-1,5
93	76	86,3	-10,3	3,2	-13,5	-5,0
94	96	90,0	6,0	0,6	5,4	-10,3
1895	76	93,7	-17,7	-1,3	-16,4	-11,7
96	79	97,7	-18,7	-2,0	-16,7	-14,9
97	99	101,8	-2,8	-0,8	-2,0	-4,8
98	114	106,1	7,9	0,5	7,4	
99	107	110,6	-3,6			
1900	126	115,2	10,8			

Curve of the secular trend — See table No. 6.

ENGLAND

NUMBER OF DISCOVERIES (YEARLY SUMS). HEAT, LIGHT, ELECTRICITY,
AND MAGNETISM.
(AUTHOR'S TABLES)

Years	Original data	Fitted data	Deviations from the fitted data	Long waves	Deviations from the long waves	Short waves
1835	4	6,5	-2,5	3,8	6,3	
36	4	6,6	-2,6	3,6	-6,2	-5,8
37	8	6,8	1,2	3,0	-1,8	-1,5
38	14	6,9	7,1	2,8	4,3	2,8
39	14	7,1	6,9	2,6	4,3	4,0
1840	11	7,3	3,7	2,5	1,2	0,2
41	5	7,4	-2,4	2,4	-4,8	-3,1
42	6	7,6	-1,6	2,3	-3,9	-2,7
43	12	7,8	4,2	2,1	2,1	-2,4
44	6	8,0	-2,0	1,7	-3,7	3,2
1845	19	8,2	10,8	1,5	9,3	0,7
46	6	8,4	-2,4	1,5	-3,9	0,1
47	5	8,6	-3,6	1,6	-5,2	-3,8
48	10	8,8	1,2	1,4	-0,2	-1,5
49	12	9,0	3,0	1,2	1,8	1,5
1850	12	9,2	2,8	0,9	1,9	2,7
51	13	9,4	3,6	0,7	2,9	1,9
52	10	9,7	0,3	0,3	0	-0,5
53	6	9,9	-3,9	0,2	-4,1	-2,6
54	8	10,2	-2,2	-0,1	-2,1	-2,1
1855	11	10,4	0,6	-0,6	1,2	1,8
56	15	10,7	4,3	-1,0	5,3	1,6
57	7	11,0	-4,0	-1,4	-2,6	1,3
58	10	11,3	-1,3	-1,8	0,5	-2,6
59	5	11,5	-6,5	-2,4	-4,1	0,6
1860	14	11,8	2,2	-3,0	5,2	1,1
61	10	12,2	-2,2	-3,8	1,6	3,2
62	9	12,5	-3,5	-4,6	1,1	0,5
63	6	12,8	-6,8	-5,3	-1,5	-1,0
64	5	13,1	-8,1	-6,0	-2,1	-1,8
1865	6	13,5	-7,5	-6,5	-1,0	-2,1
66	5	13,9	-8,9	-6,8	-2,1	-1,8

Table Nr. 8 (cont.).

Years	Original data	Fitted data	Deviations from the fitted data	Long waves	Deviations from the long waves	Short waves
1867	6	14,2	-8,2	-6,7	-1,5	-2,0
68	7	14,6	-7,6	-6,4	-1,2	-0,9
69	10	15,0	-5,0	-5,6	0,6	-2,6
1870	5	15,4	-10,4	-4,7	-5,7	-1,7
71	13	15,8	-2,8	-3,7	0,9	-2,6
72	12	16,3	-4,3	-2,7	-1,6	3,3
73	24	16,7	7,3	-1,6	8,9	3,1
74	17	17,2	-0,2	-0,3	0,1	2,6
1875	16	17,7	-1,7	1,1	-2,8	-2,8
76	16	18,2	-2,2	2,1	-4,3	-3,6
77	20	18,7	1,3	2,8	-1,5	-0,1
78	28	19,2	8,8	3,2	5,6	2,3
79	25	19,8	5,2	3,5	1,7	5,8
1880	31	20,3	10,7	4,0	6,7	3,1
81	25	20,9	4,1	4,9	-0,8	0,4
82	23	21,5	1,5	5,9	-4,4	-4,8
83	22	22,1	-0,1	6,6	-6,7	-6,4
84	25	22,8	2,2	7,1	-4,9	-5,3
1885	29	23,5	5,5	7,0	-1,5	1,6
86	41	24,1	16,9	6,6	10,3	9,7
87	46	24,9	21,1	5,8	15,3	12,0
88	35	25,6	9,4	5,3	4,1	7,5
89	30	26,3	3,7	4,5	-0,8	0,2
1890	28	27,1	0,9	3,5	-2,6	-5,6
91	20	27,9	-7,9	2,5	-10,4	-7,6
92	25	28,8	-3,8	1,7	-5,5	-10,4
93	21	29,7	-8,7	0,9	-9,6	-2,9
94	39	30,6	8,4	0,5	7,9	0,7
1895	36	31,5	4,5	1,1	3,4	4,2
96	33	32,5	0,5	1,6	-1,1	1,5
97	37	33,4	3,6	2,2	1,4	0
98	37	34,5	2,5	2,8	-0,3	0,6
99	39	35,6	3,4	3,0	0,4	
1900	40	36,7	3,3			

Curve of the secular trend — See table No. 5.

FRANCE.

NUMBER OF PHYSICAL DISCOVERIES (YEARLY SUMS). HEAT, LIGHT,
ELECTRICITY, AND MAGNETISM.
(AUTHOR'S TABLES)

Years	Original data	Fitted data	Deviations from the fitted data	Long waves	Deviations from the long waves	Short waves
1835	9	8,1	0,9	-1,8	2,7	-0,3
36	6	8,3	-2,3	-1,1	-1,2	1,2
37	11	8,6	2,4	-0,2	2,6	0,6
38	10	8,9	1,1	0,5	0,6	0
39	7	9,1	-2,1	1,2	-3,3	0,1
1840	14	9,4	4,6	1,7	2,9	-0,1
41	12	9,7	2,3	2,2	0,1	1,6
42	15	9,9	5,1	2,8	2,3	-0,1
43	11	10,3	0,7	3,4	-2,7	-1,6
44	10	10,5	-0,5	4,6	-5,1	-3,9
1845	11	10,8	0,2	5,5	-5,3	-4,7
46	12	11,1	0,9	6,3	-5,4	-1,2
47	25	11,4	13,6	6,8	6,8	-0,1
48	18	11,8	6,2	7,8	-1,6	1,1
49	18	12,1	5,9	7,6	-1,7	3,3
1850	34	12,4	21,6	7,2	14,4	0,8
51	9	12,7	-3,7	6,2	-9,9	2,0
52	20	13,1	6,9	4,9	2,0	-2,3
53	16	13,4	2,6	2,5	0,1	2,4
54	20	13,7	6,3	0,4	5,9	-0,8
1855	4	14,1	-10,1	-1,5	-8,6	-1,3
56	10	14,4	-4,4	-2,8	-1,6	-3,8
57	8	14,8	-6,8	-4,2	-2,6	-1,7
58	9	15,2	-6,2	-4,7	-1,5	-1,2
59	10	15,5	-5,5	-5,3	-0,2	-0,4
1860	11	15,9	-4,9	-5,5	0,6	0,3
61	11	16,3	-5,3	-5,8	0,5	3,0
62	20	16,7	3,3	-5,7	9,0	2,5
63	10	17,1	-7,1	-5,9	-1,2	3,5
64	15	17,4	-2,4	-6,2	3,8	0,5
1865	10	17,8	-7,8	-6,8	-1,0	1,2
66	12	18,2	-6,2	-7,3	1,1	0,1

Table № 9 (cont.).

Years	Original data	Fitted data	Deviations from the fitted data	Long waves	Deviations from the long waves	Shor waves
67	11	18,6	-7,6	-7,9	0,3	1,1
68	13	19,0	-6,0	-8,1	2,1	0,5
69	10	19,5	-9,5	-8,5	-1,0	0,6
1870	12	19,9	-7,9	-8,6	0,7	0,1
71	12	20,3	-8,3	-8,8	0,5	1,2
72	15	20,7	-5,7	-8,7	3,0	1,2
73	13	21,1	-8,1	-8,7	0,6	3,1
74	20	21,6	-1,6	-8,5	6,9	2,1
1875	14	22,0	-8,0	-7,6	-0,4	0,5
76	11	22,4	-11,4	-6,3	-5,1	-3,3
77	12	22,9	-10,9	-5,2	-5,7	-3,1
78	20	23,3	-3,3	-3,6	0,3	-1,5
79	22	23,7	-1,7	-2,1	0,4	-0,1
1880	23	24,2	-1,2	-0,2	-1,0	2,8
81	36	24,6	11,4	1,1	10,3	2,5
82	27	25,1	1,9	2,8	-0,9	1,7
83	26	25,5	0,5	4,3	-3,8	1,2
84	40	25,9	14,1	5,6	8,5	-2,1
1885	21	26,4	-5,4	6,6	-12,0	1,2
86	42	26,8	15,2	7,6	7,6	-2,2
87	32	27,3	4,7	7,9	-3,2	3,8
88	44	27,7	16,3	7,7	8,6	3,3
89	41	28,2	12,8	7,2	5,6	5,7
1890	40	28,6	11,4	6,5	4,9	5,0
91	41	29,1	11,9	5,5	6,4	3,4
92	34	29,5	4,5	4,5	0	0,6
93	29	30,0	-1,0	3,7	-4,7	-6,1
94	18	30,4	-12,4	3,6	-16,0	-6,8
1895	32	30,9	1,1	3,5	-2,4	-6,0
96	34	31,3	2,7	4,5	-1,8	-2,1
97	35	31,7	3,3	6,3	-3,0	-2,0
98	39	32,2	6,8	9,0	-2,2	-2,0
99	43	32,6	10,4	12,2	-1,8	
1900	55	33,0	22,0			

Curve of the secular trend — See table No. 4.

Medallic Illustrations of the History of Science.

(First Series : XIXth and XXth centuries).

Sixth Article.

This collection of scientific medals began to appear in volume 8 of *Isis*. The fifth article appeared in volume 12, p. 146-8, pl. 6-9, 1929. The Editor will welcome photographs or suggestions for the following parts of this series. It is intended to publish only medals having a sufficient scientific and artistic interest. Medals dedicated to scientists who are still living can not be published at once but will be considered for ulterior publication.

GEORGE SARTON.

No. 30. (FRIEDRICH HEINRICH) ALEXANDER (Baron) VON HUMBOLDT. Born, Berlin, 1769; died, Berlin, 1859. German naturalist, traveller, encyclopaedist. One of the founders of physical geography and of meteorology. *Kosmos* (1845, 1847, 1850-58, 1862).

Artist : DANIEL FRIEDRICH LOOS. German medallist; born in Altenburg, 1735; died in Berlin, 1819. (FORRER's *Dictionary*, vol. 3, 461-65).

Date : 1805.

Size : 39 mm.

Collection : American Numismatic Society, New York. Communicated by Mr. HOWLAND WOOD, New York.

Obv. : Portrait (fig. 41). FRIDER. HENRIC. ALEXANDER AB HUMBOLDT.

Rev. : Fig. 42. Novi orbis Democritus. In felicem reditum Berolini MDCCCV. (The words Atlant. Ocean. can be read upon the globe).

No. 31. PASTEUR.

Artist : GEORGES HENRI PRUD'HOMME. French medallist. Born at Cap Breton, Landes. (FORRER, 4, 704-706, 1909).



No. 30. Fig. 41 and 42. A. VON HUMBOLDT.



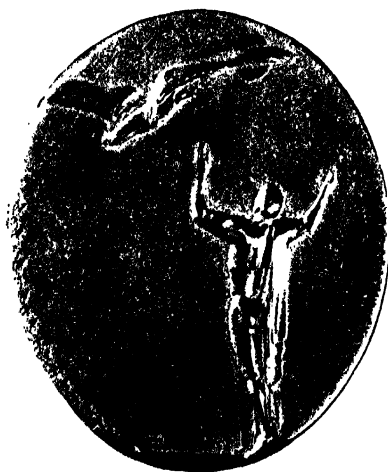
No. 31. Fig. 43 and 44. PASTEUR.



No. 32. Fig. 45. P. CURIE.



No. 33. Fig. 46. PASTEUR.



No. 34. Fig. 47 and 48. E. W. VON BRÜCKE

Date : 1910.

Size : 73 × 52 mm.

Collection : LYMAN C. NEWELL, Boston.

Obv. : Portrait (fig. 43). LOUIS PASTEUR, 1822-1895. G. PRUD'HOMME, 1910.

Rev. : (Fig. 44) G. PRUD'HOMME.

No. 32. PASTEUR.

Artist : O. ROTY.

Date : 1922.

Size : 38 mm.

Collection : L. J. HENDERSON, Cambridge, Mass.

Obv. : Portrait (fig. 45).

Rev. : Centième anniversaire de la naissance de PASTEUR.
27 décembre 1822-1922.

No. 33. PIERRE CURIE (1859-1906). French physicist.

Artist : SÉRAPHIN ÉMILE VERNIER. French medallist. Born, Paris, 1852. (FORRER, 6, 225-35, 1916).

Date : 1907.

Size : 47 × 32 mm.

Collection : Cabinet des Médailles, Paris. (Courtesy of Mme H. METZGER).

Obv. : Portrait (fig. 46). PIERRE CURIE. S. E. VERNIER, 1907.

Rev. : PIERRE CURIE. Né et mort à Paris, 15 mai 1859, 19 avril 1906. Piézo-électricité. Principe de symétrie. Magnétisme. Radium et radioactivité.

École municipale de physique et de chimie, 1882-1905. Sorbonne, 1900. Prix Nobel, 1903. Institut, 1905.

No. 34. ERNST WILHELM VON BRÜCKE. German physiologist.

Born in Berlin, 1819; died in Vienna, 1892. Physiological optics and acoustics; phonetics; physiology of colors and its application to the arts.

Artist : PETER BREITHUT. Austrian medallist, born at Krems, 1869 (FORRER, 1, 272, 1904).

Date : 1910.

Size : 66 mm. square.

Collection : L. J. HENDERSON, Cambridge, Mass.

Obv. : Portrait (fig. 47). Das KK. Ministerium für Kultus
and Unterricht dem VIII. Intern. Physiologen Kongress. Wien
1910.

Rev. : (fig. 48).

Notes and Correspondence.

1.—**International Committee of the History of Science.** — The organization of such a Committee was resolved at the international historical congress of Oslo in the summer of 1928. An initial group of seven members was then appointed including : ALDO MIELI (Paris), ABEL REY (Paris), GEORGE SARTON (Cambridge, Mass.), HENRY E. SIGERIST (Leipzig), CHARLES SINGER (London), KARL SUDHOFF (Leipzig), and LYNN THORNDIKE (New York); MIELI acting as secretary. It was decided to increase the membership up to 22 full members, and later to appoint from 20 to 28 corresponding members.

After many votes, the total membership of 22 was finally attained on Dec. 28, 1928, the fifteen new members being : FLORIAN CAJORI (Berkeley, Calif.), FRANZ MARIA FELDHAUS (Berlin), CHARLES HOMER HASKINS (Cambridge, Mass.), Sir THOMAS L. HEATH (London), LOUIS C. KARPINSKI (Ann Arbor, Mich.), EDMUND O. VON LIPPMANN (Halle a.d.S.), GINO LORIA (Genoa), HÉLÈNE METZGER (Paris), MAX NEUBURGER (Vienna), EMANUEL RÁDL (Prague), JULIÁN RIBERA Y TARRAGÓ (Madrid), JULIUS RUSKA (Berlin), DOROTHEA WALEY SINGER (London,) DAVID EUGENE SMITH (New York), ROBERT STEELE (London).

A first meeting will be held at the Centre international de synthèse, Hotel de Nevers, 12 rue Colbert, Paris, II, from May 20 to 25, 1929. The organisation will then be formally completed. In the meanwhile corresponding members will be elected, and in the future full members will be recruited only from among the corresponding members.

Beldomandi ou Beldamandi ? — C'est un grand mérite du regretté savant A. FAVARO que d'avoir fait obtenir la place à laquelle il a droit dans l'histoire des mathématiques à PROSDOCIMUS DE' BELDOMANDI. Les mémoires qu'il a consacrés à ce savant dans les Tomes XII et XVIII du *Bullettino di bibliografia e storia delle scienze matematiche* sont le fruit de longues recherches accomplies dans les archives de Padoue, où habitait l'ancienne famille à laquelle appartenait ce géomètre. Or FAVARO ne s'arrête pas à discuter l'orthographe de son nom, tous les documents qu'il examina étant d'accord à écrire BELDOMANDI. Une seule exception s'est présentée : dans son *Algorismi tractatus*, publié en 1483, l'auteur est indiqué comme PROSDOCIMUS DE BELDAMANDIS.

Evidemment FAVARO (d'accord avec un connaisseur de la littérature du Moyen Age tel que le prince BONCOMPAGNI) a regardé ce fait comme une simple faute de l'imprimeur, que ce n'était pas même le cas de relever et son exemple a été suivi par les historiens européens suivants (CANTOR, GÜNTHER, etc.). Or M. D. E. SMITH dans sa magnifique publication *Rara mathematica* a reproduit le titre de l'« *Algorithmi tractatus* »; en conséquence il a été amené à retenir que le nom du savant de Padoue doit s'écrire BELDAMANDI et cela non seulement dans l'ouvrage que je viens de citer, mais aussi dans le t. I de son *History of Mathematics* (tout en faisant remarquer que la graphie de ce nom n'était pas tout à fait constante). Or je crains que la grande autorité dont jouit à bonne raison M. SMITH ne fasse répandre (particulièrement en Amérique) cette nouvelle orthographe. Comme il s'appuie sur *un seul document*, tandis que l'autre est établie par *une foule de documents*; comme d'ailleurs il est de toute nécessité que les noms soient écrits d'une manière uniforme, j'exprime le desir que tout le monde suive l'exemple donné par FAVARO; en particulier je formule le vœu qu'il le soit par M. SMITH lui même dans les nouvelles éditions dont son *History* ne peut manquer d'être honorée à l'avenir.

(Gènes, Été 1928).

GINO LORIA.

Query no. 12. 'UMAR AL-'ÂLIM. The history of geology forming Book I of Sir CHARLES LYELL's *Principles of Geology* is still worth consulting, though with great care, and only by scholars having a sufficient knowledge of the subject to use it critically. In this case as in all others where a historical sketch was written by a scientist, the best parts are those dealing with the latest developments, and the weakest, the mediaeval. Mr. EDWIN TENNEY BREWSTER's recent book *This puzzling planet* (1928; *Isis* 12, 341) drew my attention to a passage of LYELL's historical introduction which is as much of a puzzle to me as our planet itself.

Here it is (eleventh edition, New York edition, 1872, p. 28) « In the same century also (meaning IBN SÎNÂ's time), OMAR, — surnamed EL AALEM, or The Learned, wrote a work on The Retreat of the Sea. It appears that on comparing the charts of his own time with those made by the Indian and Persian astronomers two thousand years before, he had satisfied himself that important changes had taken place since the times of history in the form of the coasts of Asia, and that the extension of the sea had been greater at some former periods. He was confirmed in this opinion by the numerous salt springs and marshes in the interior of Asia, — a phenomenon from which PALLAS, in more recent times, has drawn the same inference. »

This statement as it stands is ridiculous, yet there may be some nucleus of truth in it. I have vainly tried to find a 'UMAR AL-'ÂLIM, or an Arabic work corresponding to LYELL's short description. Is this 'UMAR a ghost? if not, who was he?

GEORGE SARTON.

Reviews

Robert W. Theodore Gunther. — *Further correspondence of JOHN RAY.* With two portraits, also two half-tone plates and six text-figures. xxiv + 332 p., illus. (Ray Society, vol. 114) London, DULAU and Co., 1928.

I doubt whether any man has done more to promote the study of the history of English science than the author of this book. Not to speak of the LEWIS EVANS collection of scientific instruments which is now available in the Old Ashmolean of Oxford chiefly because of his energy and enthusiasm (*Isis*, 6, 542), he has published a number of valuable books tending to direct the attention of his countrymen to the scientific achievements of their ancestors. I can quote here only his most important publications; for others see *Isis* by index. *The Daubeny Laboratory register* (Oxford, 1904-24; *Isis* 7, 561; 11, 481); *Early British botanists and their gardens* (Oxford, 1922; *Isis*, 5, 230); *Early science in Oxford* (3 vols., Oxford, 1920-23-25; there is a fourth volume which I have not seen; *Isis*, 6, 449-53; 8, 375-77).

The present volume is an important addition to our knowledge of JOHN RAY, who was one of the greatest naturalists of the second half of the seventeenth century. It is a companion to two other volumes published by the same society: *the Memorials of JOHN RAY* (1846) and *the Correspondence of JOHN RAY* (1848), both edited by EDWIN LANKESTER. The second of these volumes contained far more letters addressed to RAY than written by him. Thanks to GUNTHER's energetic curiosity, this situation is now reversed in the new volume wherein are published for the first time a number of valuable letters written by RAY to various correspondents, chiefly to JOHN AUBREY, the Oxford antiquary (14 letters), and to EDWARD LHWYD (41 letters). The correspondence thus far published in these two volumes extends from 1658 to 1704. I may recall that RAY was born at Black Notley in Essex on Nov. 29, 1627 (not 1628), and that he died at Black Notley, on Jan. 17, 1704-05 (not 1705-6, as is wrongly inscribed on his tomb). GUNTHER has added to the correspondence two short lives of RAY, the one written by the latter's great friend the botanist SAMUEL DALE of Braintree (1659?-1739), the other written in 1711-12 by another friend, JAMES PETIVER (1663-1718), who was an apothecary and naturalist.

Among the other correspondents of RAY represented in these two volumes are PETER COURTHOPE of Danny, FRANCIS WILLUGHBY, MARTIN LISTER, HENRY OLDENBURGH, TANCRED ROBINSON, and HANS SLOANE. This is enough to show their interest to students of science in the second half of the seventeenth century.

By far the most important part of that correspondence is that exchanged with LHWYD (1689-1703). LHWYD's letters had been published by CARPENTER, but RAY's do now appear for the first time (p. 185-284). EDWARD LHWYD (1), the second keeper of the Ashmolean Museum in Oxford was a young naturalist of considerable promise but who died prematurely; he was at least thirty-three years younger than RAY but there is not the slightest suggestion of inequality in the letters of the older man. LHWYD was engaged in a study of fossils, and a large part of RAY's letters deals with the mysterious problems involved. RAY was deeply interested in his young friend's design of publishing a « catalogue of formed stones » but wisely counseled him not to restrict it to the neighborhood of Oxford but to extend it to the whole of England. His many discussions of the origin of fossils form a very valuable addition to what might be called the prehistory of palaeontology (see e.g., p. 219, 223, 259, 264, 278, 284). It enables us to measure how extremely difficult the problem was. The following extract from RAY's letter of Feb. 3, 1695, may serve as an example :

« I know it is a hard task to give a good Account of the originall of Fossill shels & formed stones, & a satisfactory Answer to all Objections against either opinion : & therefore a man hazards his reputation that is positive & confident on either side. The like may be said of the Delineations of Plants upon Slate or other stones. I did once embrace a middle way, to wch I see you are now somewt inclined, but now I think that if nature may form any for her disport, she may as well form all, & I see no reason of making a difference between them. And if reall shels & Fish-bones be found at great distances from the sea, it may rationally be thought that the formed stones wch are there found may ow their originall to them, especially since it is observed that oyster shels will in time thicken & grow into the shape of those stones wch (have) bene found in gravell pits & wch the vulgar heer call hobgoblins claws. »

Strangely enough the consideration of fossils entailed that of embryology. Witness this extract from a letter of March 12, 1697.

« I am of opinion with you, that the severall parts of animate bodies are made of ye severall parts of the seed. I can also easily allow that these parts may be separated & act separately from each other, as appears by monsters wanting some parts, & having others in undue places or enormously great. Only we see that the seeds of these bodies (wch are indeed nothing else but the very bodies themselves in piccolo, indeed with mentative power) grow by separating parts from

(1) About him, see *Isis*, 8, 377. The strange name LHWYD is but a variant of the better known LLOYD. RAY wrote it LLOYD.

a fluid, & continually applying them to themselves. Now it is hard to conceive how this can be done in stones. The instance of those sorts of Fern-leaves observed in ye ice of urine &c. answers not to the formation or rather ye growth of an animate body from ye seed, that being done by one simple projection at once, not to say this urine is the greatest enemy to vegetation that may be. Some objection also against this Hypothesis, for it may be, that according to Dr. WOODWARD's observation these bodies are for the most part found sunk and lodged in beds of the same specific gravity. Then the lodging of shells in beds or strata of mud or gravell, & some of them being by long lying as it were calcined & easily dissoluble to powder doth as it were tell us, that such beds were sometimes the sea-shore, it requiring a very long time so to calcine these shels. Heer at Harwich a bed of shells hath lately been found by Mr. DALE, near the top of the cliff, at least 40 foot above ye shore; this bed of a considerable thickness, mixt with sand & gravell. There-in are all sorts of Bivalves & Cochleæ most of them calcined to powder or in small fitters, yet many entire, & some large turbens that have a contrary turn. (*) »

In view of the recent discussions in American newspapers (April 2, May, 4, 6, 15, 1928) apropos of the occurrence of live toads inside of stones, it is amusing to find similar cases mentioned in RAY's letters of 1692 and 1697 (p. 227, 271), which shows that there is nothing new under the sun.

GEORGE SARTON.

Armand Delatte. — *Anecdota atheniensa*. Tome 1. Textes grecs inédits relatifs à l'histoire des religions. (*Bibliothèque de la Faculté de philosophie de l'Université de Liège*, fascicule 36) VIII + 740 p. Liège, 1927.

Il faut savoir bon gré à M. DELATTE, professeur à l'Université de Liège, pour cette édition consciencieuse de nombreux textes inédits, qui nous aideront à mieux pénétrer la pensée du peuple byzantin. Je dis peuple, car la plupart de ces documents peuvent à peine être considérés comme des œuvres littéraires; comme le dit l'auteur « ils suent la vie du petit peuple ». Il faut noter que la plupart sont relativement récents; la majorité des Mss. étudiés datent des XVII^e et XVIII^e siècles, certains sont même du XIX^e.

J'aurais peut-être mauvaise grâce à reprocher à l'auteur un certain manque d'ordre, car après tout, libre à chacun d'utiliser ses documents dans l'ordre qui lui plait, et nous lui devons déjà beaucoup de reconnaissance pour la tâche infiniment ingrate qu'il a accomplie. L'édition d'un beau texte, si pénible qu'elle soit, doit être une grande source de joie; mais j'admire l'auteur d'avoir édité avec tant de soin des textes aussi médiocres, parce que je serais moi-même tout à fait incapable de dépenser ainsi mon énergie et ma dévotion.

(*) *Trophon antiquus*.

Il est fâcheux cependant que les textes qui nous sont donnés n'aient point été partagés en trois groupes bien distincts : (1) magie; (2) religion; (3) physiologos.

(1) *Magie* — Le premier groupe est de beaucoup le plus important; il forme les quatre cinquièmes du total. Ce volume n'est donc pas ce que nous dit le sous-titre, mais essentiellement un recueil de recettes magiques de toutes sortes. On pourrait comparer celles-ci aux recettes égyptiennes qui ont été récemment réunies par FRANÇOIS LEXA de Prague (3 vols., Paris, 1925; *Isis*, 9, 450-52). Toutes ces recettes en effet se ressemblent bien fort. Plus ça change, plus c'est la même chose. Comme je l'ai longuement expliqué à propos de l'histoire de la magie de LYNN THORNDIKE (2 vols., New York, 1923; *Isis*, 6, 74-89), je ne pense pas que l'histoire de la magie offre beaucoup d'intérêt pour l'historien de la science. Ce qui fascine celui-ci au-dessus de tout, c'est de contempler et d'expliquer le progrès du génie humain. L'activité scientifique est la plus progressive et la plus révolutionnaire de toutes les activités humaines; au contraire il n'y a rien de moins progressif, ni de plus réactionnaire que la magie. Exception faite pour les aspects plus scientifiques de l'alchimie et de l'astrologie, il n'y a donc aucun rapport entre l'activité des savants et celle des magiciens. J'ajouterai que les points de contact entre ces derniers et les esprits religieux ne sont guère plus nombreux; quand ils existent, ils sont purement accidentels. Le savant, le saint, et le magicien représentent trois types essentiellement différents. Les deux premiers sont des frères, quoiqu'ils l'oublient parfois; ils pourraient être comparés à des alpinistes gravissant la même montagne de côtés différents; il est possible qu'ils se rencontrent au sommet. Mais le troisième ne se meut que dans la boue des plaines; s'il rencontre les deux autres, ce ne sera certainement pas sur la montagne.

Il serait futile de vouloir analyser ces traités de magie. Il suffira de dire qu'on y trouve toute la gamme habituelle : lécanomantie ou évocation des esprits, formes anciennes de l'hypnotisme, rites d'envoûtement, d'ordalie, de divination, magie sympathique, usage d'alphabets secrets et de « sceaux » ou « caractères » magiques, etc. etc. Nous avons ici toutes les formes traditionnelles de divination : par les nombres ou les lettres, les songes, les lignes des mains, les omoplates, etc. Il y a aussi un grand nombre de recettes magiques indépendantes, c'est à dire qui ne se rattachent à aucun des grands groupes, — des superstitions particulières et locales. En effet il n'y a rien qui ne puisse donner lieu à des interprétations irrationnelles; tous les problèmes de la vie peuvent suggérer des solutions magiques aux gens qui sont suffisamment ignorants et déséquilibrés.

(II) *Religion*. — Certains textes sont d'un ordre plus élevé, et remplissent mieux la promesse du sous-titre. Ils sont malheureusement beaucoup

moins nombreux : l'Evangile de l'enfance, de Jacques; l'apocalypse de la Vierge; l'invention de la croix; l'histoire de la fondation de Ste. Sophie; un fragment sur les hérésies; une chorographie ecclésiastique; des propriétés théosophiques; une histoire de la naissance et de l'éducation de MAHOMET. Tous ces textes, qui sont comme on le voit assez variés, couvrent un peu moins de cent pages. Il ne peut-être question de les discuter ici, mais je les signale aux historiens des religions.

(III) *Physiologos*. — L'auteur édite deux Mss. du XVII^e siècle. Le no. 1008 de la Bibliothèque nationale, dont le contenu est tout à fait différent du *Physiologos* ancien ou byzantin que nous connaissons (voir mon *Introduction*, vol. 1, 300). L'esprit en est plus objectif, plus scientifique, moins moralisateur, moins religieux. Ce texte est assez long, une trentaine de pages. L'autre, le Parisinus suppl. gr. 223, était originellement plus long encore, mais il n'en reste qu'une petite partie (10 p. de cette édition.)

L'ouvrage est complété par un glossaire assez volumineux (p. 657-736). J'aurais aimé une liste séparée des noms de personnes. Voici ceux mentionnés dans les titres : Onirocrite de BLAISE L'ATHÉNIEN, Testament de SALOMON (trois fois), Onirocrite de MANUEL PALÉOLOGUE.

L'auteur, ancien membre de l'Ecole française d'Athènes, a publié précédemment des Etudes sur la magie grecque dans le *Bulletin de correspondance hellénique* (vols. 37 et 38) et le *Musée Belge* (vols. 17, 18, 26); des Etudes sur la littérature pythagoricienne (Paris, 1915); un Essai sur la politique pythagoricienne (Liège, 1922); La vie de PYTHAGORE de DIOGÈNE LAËRCE (Bruxelles, 1922); le vol. 10 du *Catalogus codicum astrologorum graecorum*, Cod. Athenienses (Bruxelles, 1924), et Les manuscrits à miniatures d'Athènes (Liège, 1926).

GEORGE SARTON.

Obed Simon Johnson. — *A Study of Chinese Alchemy*. XII + 156 pages. The Commercial Press, Shanghai, 1928.

A close study of Chinese alchemy is an urgent desideratum, but the present book unfortunately does not fill this want. To one who is not acquainted with the subject it may be recommended as a first aid provided he does not take it too seriously. The book lacks depth, viewpoint, method and criticism. It hardly contains any new facts, no clear exposition of Chinese alchemy, a heavy excess baggage of irrelevant matter, and a strong dose of unsound speculations. The first two chapters on Taoism and the changing concept of early Taoist teaching bear no direct relation to the subject, and are chiefly a compilation from second-hand sources. They are intended to produce the impression as though alchemy had naturally grown out of the soil of Taoism. This is the author's first fundamental error. Alchemy, in fact, is an entirely foreign element

in Chinese thought and suddenly shoots up in the second century B.C. under the emperor Wu when China was actually flooded by an invasion of influences rushing on from the West. If Mr. JOHNSON will read MASPERO's critical work *La Chine antique*, he will probably modify his untenable thesis that alchemy had its origin in China and spread from there to the West. Taoism is not a religious unit, but a syncretistic system that has absorbed all sorts of extraneous elements, among these also the alchemy of the West; in primeval Taoism there is not a trace of alchemy.

The most disconcerting blunder of the book, however, is the intimation that the Chinese alchemist's object in transmuting base metals into gold was dictated by a desire for riches and for a life of comfort and ease. « The desire for gold being a universal phenomenon, it is reasonable to believe that, apart from the matter of personal avarice, popular demand was a most potent incentive in the search for gold through the process of transmutation » (p. 70). I doubt that any more unreasonable statement in regard to the Chinese could be found. In the first place, they cannot be accused of having ever been obsessed by the thirst for gold, nor is gold a synonym for riches in China, as the author boldly but wrongly asserts. There is not even a plain word for gold in the Chinese language; gold is only known as the « yellow metal ». The metal earliest known to the Chinese was silver, and next to it copper. Silver and copper, but never gold, formed the currency of China. In the second place, China is so rich in gold, and gold is so easily obtained from the sand of her rivers that it is the utmost absurdity to suggest that the alchemists expended their efforts on making gold artificially just for the fun of making money. They did so because they believed that gold produced by the processes of alchemical sublimation and transmutation was endowed with a superior vitality and efficacy in the endeavor to reach salvation and immortality; it was not gold as a metal they craved, but gold of a transcendental quality that would promote the spiritualization of the body. The term *yün-mu* does not mean « mother-of-pearl » (p. 87), but « mica, » which has played an extensive role in Chinese burial practice.

The stale legends concerning the introduction of Buddhism into China are reiterated (p. 90) without any knowledge of FRANCKE's and MASPERO's critical work which long ago exploded the native traditions. Modern sinological science is entirely foreign to the author. Nothing is said about the alchemy of India and its relation to that of China. RAY's *History of Hindu Chemistry* marches in the parade of the Bibliography, but is not made use of by the author. The important studies in Arabic alchemy published by WIEDEMANN and his school are unknown to him.

The preface mentions a photostat copy of a valuable work in the Library of Congress on Chinese alchemy, listed on p. 134 and described in three

sentences from a review of the work by the Chinese assistant in the Library of Congress. In the index, this is referred to as a « descriptive account. » In the body of the text just a single quotation from this work consisting of three sentences is given. What we need in the present state of science are complete translations or at least critical digests of Chinese books of alchemy; what we need are profound research, hard and intensive work, not talk, theories and speculations dressed up in a smiling book.

The bibliography offers a great surprise. It gives the titles of numerous works which contain nothing about alchemy, while important treatises on the subject are omitted. A useless book like BALL's *Chinese and Sumerian* is cited. PELLLOT's name is printed on p. 140, but not one title of his numerous works is listed. The author's work shows plainly how little familiar he is with the literature arrayed by him. On p. 134 he asserts that the *Shen sien chuan* has not been translated, while on p. 137 he quotes DE HARLEZ, *Le livre des esprits et des immortels*, which in fact is a translation of the Chinese work in question. The *Ts'an t'ung ki* is described « as the oldest complete work dealing with Chinese alchemy. » WYLIE's (*Notes on Chinese Literature*, p. 218) correct judgment that this book and its doctrine « have been by common consent discarded by the literati » is simply disregarded. The *Po wu chi* is not « a treatise on natural science, » but a collection of mirabilia and much fictitious matter. Instead of T'ung-fang Shu on p. 133 read T'UNG-FANG SO. The work of HUAI NAN-TSE, « of which there is no translation, » has in part been translated into Russian by IVANOV. WIEGER's *Le Canon taoiste* is inserted in the Bibliography, but apparently not utilized; it contains a long list of alchemical books which if the author had studied them would have greatly increased the value of his production. Let us hope that he will continue his studies and give us something better in the future.

Chicago.

B. LAUFER.

Florian Cajori. — *A history of mathematical notations*. Two volumes.

Vol. I : Notation in elementary mathematics. xvi + 451 p. 106 fig., Chicago, Open Court Publishing Co., 1928. (\$ 6).

Historians of mathematics have anticipated so long the publication of this great work, that a review of it may seem almost superfluous. Indeed it is the kind of book of which it would almost suffice to say : « Here it is ! Know you all that it has finally appeared. » But I bear in mind that many of our readers are less experienced, and for their sake — they who will succeed us and continue our task — it is necessary to give more information.

The author's introduction is so short, that we may allow him to state his purpose with his own words :

« In this history it has been an aim to give not only the first appearance of a

symbol and its origin (whenever possible), but also to indicate the competition encountered and the spread of the symbol among writers in different countries. It is the latter part of our program which has given bulk to this history. The rise of certain symbols, their day of popularity, and their eventual decline constitute in many cases an interesting story. Our endeavor has been to do justice to obsolete and obsolescent notations, as well as to those which have survived and enjoy the favor of mathematicians of the present moment. If the object of this history of notations were simply to present an array of facts, more or less interesting to some students of mathematics — if, in other words, this undertaking had no ulterior motive — then indeed the wisdom of preparing and publishing so large a book might be questioned. But the author believes that this history constitutes a mirror of past and present conditions in mathematics which can be made to bear on the notational problems now confronting mathematics. The successes and failures of the past will contribute to a more speedy solution of the notational problems of the present time. »

This first volume deals with elementary mathematics : Arithmetic and Algebra (400 p.) and Geometry (31 p.). This disproportion (31 p. vs. 400) is curious. We must assume that it is not at all due to the author, but to the subject itself; but this makes it all the more astonishing. What could be the explanation? Perhaps that geometry required symbols only when it became theoretical whereas the need of arithmetical symbols was obvious just as soon as the abacus stage was passed. Arithmetical symbols paved the way for the algebraical ones, while the geometrical need remained unheeded. And yet geometry developed far earlier than arithmetic... This suggests at once another puzzle. How is it that the Greeks who gave proof of so much mathematical genius, showed so little invention in the field of notation? Perhaps, because in their days writing was still uncommon, and most mathematical thinking pure headwork? I quote these puzzles to evidence the great psychological interest of these austere investigations.

To return to CAJORI's book, a first section (70 p.) is devoted to the « Numeral symbols and combination of symbols. » The author passes in review all the ancient civilizations : Babylonians, Egyptians, Phœnicians and Syrians, Hebrews, Greeks, early Arabs, Romans, Peruvians and North Americans Aztecs, Maya, Chinese and Japanese, and discusses the development of Hindu-Arabic numerals. The problems raised by these numerals are extremely important, not only because of their ubiquity, but also because they may serve to illustrate the whole subject of notation from its most concrete to its most abstract standpoint.

After this comes a very elaborate analysis of the arithmetical and algebraical symbols, used by individual authors : DIOPHANTOS, BRAHMA-GUPTA, the author of the *Bakshālī Ms.*, BHĀSKARA, etc., down to the beginning of the eighteenth century. This final period is aptly represented by two editorial communications extracted from the *Acta eruditorum* (Leipzig, 1708, p. 271) and from the *Miscellanea berolinensia* (1710, 155).

Both editorials recommend the use of a system of notations which might be called the Leibnizian (in fact, the second was written by LEIBNIZ himself). It is strange, by the way, that a study of LEIBNIZ's elementary notations was not included in this volume. The reason of this gap is that the author intends to deal with LEIBNIZ in vol. 2; this is well enough for the readers owning both volumes, but is hardly fair to those who do not otherwise need the second volume. Let us hope however that these one volume readers will be a small minority. My only other criticism (and it is a minor one) is that the various authors have not been placed in a stricter chronological order. Why place AL-KHWÂRIZMÎ after BHÂSKARA, LEONARDO OF PISA after PLANUDES, PIETRO BORG after ESTIENNE DE LA ROCHE, etc.? This does not matter so much, if the reader is aware of it and replaces mentally these paragraphs in their proper succession. To show the complexity of the subject, of which present-day mathematicians are blessedly unconscious, « there were at the close of the sixteenth century twenty-five or more varieties of symbols for the calculus of radicals with which the student had to be familiar, if he desired to survey the publications of his time. » The main heroes of this long account, outside of LEIBNIZ — who remains hidden behind the veil — were the two Englishmen, WILLIAM OUGHTRED, whose *Clavis mathematicae* was first published in 1631, and JOHN WALLIS, whose *Arithmetica infinitorum* appeared twenty-four years later. That OUGHTRED thoroughly understood the implications of the subject, is clear from the following quotation (Circles of Proportion, 1632, p. 20).

« This manner of setting downe theoremes, whether they be Proportions, or Equations, by Symboles or notes of words, is most excellent, artificiall, and doctrinall. Wherefore I earnestly exhort every one, that desireth though but to looke into these noble Sciences Mathematicall, to accustome themselves unto it : and indeede it is easie, being most agreeable to reason, yea even to sence. And out of this working may many singular consecretaries be drawne : which without this would, it may be, for ever lye hid. »

This long analysis is followed by a rearrangement in topical order of all the material thus far obtained. I quote the titles of each section and for the sake of illustration, I also mention the subsections of the first section.

Signs of addition and substraction (divided as follows : Early symbols; origin and meaning of the signs; spread of the + and — symbols; shapes of the + sign; varieties of — signs; symbols for « plus or minus »; certain other specialized uses of + and —; four unusual signs; composition of ratios). Signs of multiplication. Signs of division and ratio. Signs of proportion. Signs of equality. Signs of common fractions. Signs of decimal fractions. Signs of powers. Signs for roots. Signs for unknown numbers. Signs of aggregation.

As already remarked, the geometrical section is considerably shorter. It is classified in the following order : A. Ordinary elementary geometry. Early use of pictographs; signs for angles; signs for « perpendicular »; signs for triangle, square, rectangle, parallelogram; the square as an operator; sign for circle; signs for parallel line; signs for equal and parallel; signs for arcs of circles ; other pictographs; signs for similarity and congruence; sign for equivalence; lettering of geometric figures; sign for spherical excess; symbols in the statement of theorems; signs for incommensurables; unusual ideographs in elementary geometry; algebraic symbols in elementary geometry. B. Past struggles between symbolists and rhetoricians in elementary geometry.

My analysis of CAJORI's great work, however long, can hardly give an adequate idea of the abundance of material which has been so thoroughly worked out by him. I must add that a large number (106) of well chosen facsimiles will enable the reader to see some of the fundamental documents with his own eyes. One of the concluding paragraphs may still be quoted, if only to prove that these minute investigations have not deadened the author's soul :

« The experience of the past certainly points to conservatism in the use of symbols in elementary instruction. In our second volume we indicate more fully that the same conclusion applies to higher fields. Individual workers who in elementary fields proposed to express practically everything in ideographic form have been overruled. It is a question to be settled not by any one individual, but by large groups or by representatives of large groups. The problem requires a consensus of opinion, the wisdom of many minds. That wisdom discloses itself in the history of the science. The judgment of the past calls for moderation. »

The main lesson which this book teaches is the slowness and timidity of human advance. One can take a horse to a trough, but not make him drink. A man of genius may invent a new device the adoption of which would save an infinite amount of energy — Hindu numerals, decimal notation, metric system, etc. — but nobody can oblige mankind to use that device. In fact history shows that the adoption was in almost every case extremely slow : it took centuries to introduce the Hindu numerals into Europe, and these notations are not yet entirely unified; the metric system of which SIMON STEVIN had guessed the principle as early as 1585, (*Isis*, 7, 543), is not yet understood by a vast portion of the civilized world of to-day !

To complete this review, I wish to pay a full tribute to the enlightened generosity of the Open Court Company, which has not hesitated to publish a book, so difficult to print, and to publish it in such a handsome way. I believe that no American publishers, — not even the University Presses, have shown as much disinterestedness and devotion to science as the Open Court Company. American scholars owe a deep debt of

gratitude to the HEGELER family, to the much lamented PAUL CARUS, and to his widow Mrs. MARY HEGELER CARUS. The richer and more powerful publishers become, the more commercial and greedy they tend to be; they have to think of their enormous overhead expenses, of their shareholders, etc. It is true of them, as it often is of individuals, that increased wealth makes generosity more difficult. The Open Court Company has shown another and better way; it cannot be honored too much.

GEORGE SARTON.

Erik Nordenskiöld. *The history of biology.* Translated from the Swedish by LEONARD BUCKNALL EYRE. With many portraits. XII + 629 + xv p. New York, KNOPF, 1928 (six dollars).

The publication of the English translation of this great work is very welcome, and we are especially anxious to devote to it the full review it deserves, because we failed to review the original Swedish edition, *Biologins Historia* (3 vols., Stockholm, 1920-24) and the German translation, *Die Geschichte der Biologie* (XIII + 648 p., Jena, 1926).

Thus far, strangely enough, we had only one history of biology worthy of the name, that is RÁDL's *Geschichte der biologischen Theorien* of which two very different editions appeared, the first in 1905-1909, the second in 1913. EMANUEL RÁDL is a Czech physiologist, who is now professor of « Naturphilosophie » in the Karlova Universita of Prague. His history is very elaborate, well documented and well written, but far too subjective, especially in the second edition. It is dominated by the author's curious philosophical views — a combination of vitalism, anti-Darwinism, and romanticism in the style of the old German « Naturphilosophie », together with an increasing distrust of objective science and with an enthusiastic admiration of ARISTOTLE, PARACELSUS, and DOSTOIEVSKY ! Such a work is certainly stimulative, though the author does but too often overreach himself, and I wonder how many readers have the patience to follow him to the end, unless they happen to share his peculiarities. Whichever the merit or demerit of RÁDL's « realistic cosmic view », one thing cannot be denied, his history lacks objectivity. It is less a history, than a philosophical discussion of evolving biology.

To return to NORDENSKIÖLD, his account is far superior in almost every respect, and it has the fundamental quality of objectivity. That is, the author has made throughout an earnest effort to be as objective as it is possible to be. For example, he is himself anti-Darwinian, and seems to favor a sort of compromise theory (« a mutational Lamarckism »), yet his discussion of that great subject is entirely fair, — which does not mean that it will satisfy everybody.

The first question I ask myself about a work of encyclopaedic proportion is « How is it built? » It is clear that it is impossible to examine every

detail of it, but we can appraise its general plan. Now out of 614 pages, 65 are devoted to antiquity, 14 to the Middle Ages, 39 to the Renaissance, 180 to the seventeenth and eighteenth century, and 316 (half of the work) to the nineteenth century. These proportions are not bad, but a further examination reveals architectural defects, one of which at least is very serious. The account of the Middle Ages is utterly insufficient, but we can hardly blame the author for this, especially if one remembers that his work was first published in 1920-24, and has not been revised since. The account of pre-Homeric science is even less satisfactory, but again this is more or less excusable in our present state of knowledge and if one considers that the author is a zoologist, not an archaeologist.

But there is one thing that I cannot forgive as easily, that is the treatment of the seventeenth and eighteenth centuries, as if these two centuries constituted but one homogeneous period. This is, I believe, a capital error. That section is preceded by a philosophical introduction which carries us rapidly from DESCARTES to VOLTAIRE, then we are thrown back again into the Renaissance, so that PARACELUS is discussed after VOLTAIRE; NORDENSKIÖLD exaggerates the importance of the latter, and forgets to speak of the « Encyclopaedists », whose activity influenced the scientific world more deeply. As an instance of that influence, I may recall JACQUES LOEB's genuine admiration of them, an admiration which he expressed to me at least twice. There was as deep a difference between the seventeenth and eighteenth centuries as between the eighteenth and nineteenth. Mixing them, as the author does, is confusing to any reader, — and how terrible it must be for biologists, their name is legion, whose historical background is a little shaky ! They are continually thrown from the sixteenth century into the eighteenth or nineteenth and back again. I have already given an example of such laxity, PARACELUS following VOLTAIRE, but there are many others and worse ones. DIOSCORIDES appears only on p. 191, after VOLTAIRE, and so does OTTO BRUNFELS. We leave VOLTAIRE on p. 130, to meet BUFFON only on p. 219. Apropos of this, I was well pleased to see the author's fair judgment of him. After being too much admired, poor BUFFON has been unjustly despised (see *Isis*, 9, 446); it was time to rehabilitate him. On the other hand, RÉAUMUR deserved to be treated more elaborately, for he was also one of the very greatest biologists of his time.

But I must quote other examples of chronological laxity, because this is the main defect of an otherwise excellent work. Moreover, this is the main defect of most books dealing with the history of science; and I have promised myself to denounce it as vigorously as I can on every opportunity, because we shall not have a sound knowledge of the development of science until that essential defect is eradicated. What would we think of a statistician who would get mixed up in his figures

and quote heterogenous data promiscuously? What would we think of a zoologist who would quote different kinds of animals promiscuously, and give the impression that they all belong to the same group? We must think the same of historians whose chronology is confused.

To illustrate the author's laxity in this respect, consider the following sentence, which precedes a statement of COMTE's positive philosophy. The author speaks of the influence exerted by the progress of physics and chemistry :

« And the results that these sciences achieved were very clearly brought home to the world in general, owing to their splendid application to practical life, which was then just beginning and which afterwards represented perhaps the most striking characteristic feature of the century; it was then that the influence of steam-power on industry and communications first began to be realized; it was then that the significance of chemistry in numberless fields of activity began to make itself felt in the daily life of humanity, not to speak of the somewhat later application of electrical phenomena in practical every day life. »

Now the « somewhat later » means at least half a century — half of the nineteenth century ! — for electricity did not really influence practical life until the last quarter of the century. The steam engines were pre-Darwinian, the whole industrial revolution was pre-Darwinian, but practical electricity (except telegraphy) was post-Darwinian (I mean, of course, post-1859).

Other example : the account of MENDEL's work follows that of W. L. JOHANNSEN's, though the latter was still a child when MENDEL published his first paper, in 1865 (1866). The date of that paper is not mentioned (the bibliography at the end only quotes a reprint of it, 1913), and the student is given no inkling of it; in fact, if he did not notice MENDEL's birthdate, he would easily be led to imagine that MENDEL followed JOHANNSEN. You see how chronological laxity inevitably creates historical distortions. One can not repeat it too often : chronology is the backbone of history; leave it out, and your narrative falls to pieces.

I have already praised the author's objectivity with regard to conflicting theories; his objectivity with regard to nationalities is no less remarkable. In this he was undoubtedly helped by his own nationality, for it is a good deal easier for a Scandinavian, than for, say, a Frenchman or a German, to appraise impartially the competitive activities of French and German biologists. Yet I have many reasons to believe that his sources were preponderantly German. Do you wish to know what this Scandinavian has to say of CESALPINO?

« His (CESALPINO's) ponderous and involved presentation of his case — vague, too, in comparison with SERVET's brief and explicit style — has enabled his admirers to interpret his statements as it suits their

purposes, but just as none of his contemporaries saw in him one who had revolutionized knowledge of the vascular system — a fact which he, himself, Catholic and papal favourite as he was, would hardly have dared to admit — so there must in truth be a partisan and chauvinistic spirit in those of posterity who would ascribe to him the honour of an idea which he himself neither clearly expressed nor ever definitely claimed.»

I shall now indicate a few points which have attracted my attention. The accounts given of CLAUDE PERRAULT and STENO are good, and the discussion of the views of HOFFMANN, STAHL, and BOERHAAVE excellent. I also liked the chapter devoted to GOETHE, and the vindication of GALL. But it is shocking to see that only two pages are given to CLAUDE BERNARD against twenty three to HAECKEL ! BERNARD's very original studies on the physiological action of various poisons are just mentioned, and that mention is so vague that it is useless. The account of GALTON is equally insufficient, and it is clear that the author has hardly understood the importance of biometry; I hasten to add that this is the only great question that I can think of, which has been almost entirely neglected by him. Practically nothing is said of eugenics, which I think is a mistake, but one more defensible. A history of biological theories may omit applications, such as eugenics; there is no excuse for neglecting the statistical or biometrical point of view.

Most biologists will turn at once to the second half of the book dealing with the nineteenth century, and their criticism will vary exceedingly from one man to another according to the special studies of each. It is not possible to write a complete history of the nineteenth century; it is necessary to make a selection, and a very severe one at that. No two scientists could entirely agree on the same selection. The author fully realized the difficulties of his task, as the following extract will show :

« Undoubtedly the greatest service to biology that has been performed by modern cell-research, is its having given us our present knowledge of the course and significance of fertilization — a discovery worthy to be placed by the side of the explanation of the circulation of the blood in the seventeenth century. If, however, we compare the course of these two great achievements in the field of research, we get a striking impression of the contrast that exists between scientific activities nowadays and those of a couple of centuries ago. On the one hand, HARVEY, who spent twenty years or so quietly and peacefully examining the idea that had been kindled in him in his youth, and who afterwards submits it to the world in its perfect and consummate form. On the other hand, a number of scientists of today, some of them admittedly of the highest rank, working all at the same time in mutual rivalry at the problem of fertilization, expound their results practically every year, often in a half-

finished state and sadly in need of emendation, and then disputing each others' claim to the honour of having produced the various details of the discovery, each one seeking to interpret according to his own lights statements that are often found to have been originally formulated as mere assumptions and suggestions. The account of how our knowledge of the origin of individual life was finally acquired can therefore hardly be so attractive a task as that of describing HARVEY's lifework.»

Imperfect as it is, NORDENSKIÖLD's work marks a considerable advance. Thanks to him, it will now be possible to teach the history of biology with relative ease, and to refer students to intelligent and comprehensive discussions of the main problems. Every biologist or physician reading this book will obtain not only a good idea of the development of biology, but at once a good philosophical introduction to his studies. Every teacher of biology ought to read it.

Some day we shall have, I hope, a better book. May be the author himself will give it to us? But in the meanwhile, his present book is the best history of biology available in any language; and the only one — I mean, the only philosophical one — available in English.

GEORGE SARTON.

Edward Heron-Allen. — *Barnacles in nature and in myth.* xv + 180 p., 53 fig. Oxford University Press, 1928 (15 s.).

This delightful volume is divided into three parts of which the first gives the natural history of *Lepas anatifera* and *Balanus balanoides*, «the pedunculate or stalked species thrown up on our shores adherent to logs of driftwood, and the sessile species growing upon our rocks, and so deleterious to bathers and the bottoms of ships.» The second part deals with the myth relative to *Lepas anatifera*, myth which the very name records, for *anatifera* means goose-bearer. (It is also recorded by the name *bernicle* for the goose in the genus *Anser*). The author has taken considerable pains to trace the history of that myth. The first authoritative statement of it was given by ALEXANDER NECKAM or by GERALD THE WELSHMAN, both of whom flourished in the second half of the twelfth century; but the myth had already been mentioned before that by PIETRO DAMIANI, cardinal bishop of Ostia (eleventh century). The third part is devoted to the study of several representations of what might be called «barnaculized geese» upon Mycenaean pottery. The late FREDERIC HOUSSAY (*Isis*, 7, 433-55) was the first to draw attention to this in the *Revue archéologique*, 1895, and the study of that fascinating subject was continued by Sir RAY LANKESTER in his *Diversions of a naturalist* (London, 1915). This carries the barnacle myth back to Mycenaean times, Nothing unpalatable in this, but how was the myth transmitted to us, how did it bridge the enormous gap between the ninth

century B.C. and the eleventh century after Christ? The mystery is increased by the fact that the myth occurs neither in Greek nor in Roman lore.

This book is admirably illustrated, and contains abundant notes, but unfortunately these are printed behind the text, making reference to them very tiring. According to his own admission the author has « an ineradicable passion for verifying references and a hobby for footnotes amounting to mania »; how then did he ever allow them to be printed in such inconvenient way that most of them are bound to remain unread?

GEORGE SARTON.

Edwin Tenney Brewster. — *This puzzling planet.* The earth's unfinished story; how men have read it in the past, and how the wayfarer may read it now. 328 p., illustrated. Indianapolis, BOBBS-MERRILL Co., 1928. (\$4).

The author needs no introduction to our readers, for two excellent books of his are already well known to them (or ought to be), his *Understanding of Religion* (Boston, 1923) and his *Creation*. A history of non-evolutionary theories (Indianapolis, 1927), both of which were fully reviewed in *Isis* (vol. 7, 162-65; vol. 9, 462-65). The present volume, which deals with geology, is fully as good as its two predecessors. It deserves to arrest our attention, because the author never neglects the historical aspects of his subject. And through his historical knowledge is sometimes deficient, I like his books because of their scientific soundness.

I have often said, but it bears repeating, that the difficulty of the history of science is due to the fact that it is, as its name indicates, a combination of history and of science. The complete historian of science must have a deep understanding of science and be a good historian. Such combination of knowledge and aptitude is necessarily rare, and we must be satisfied, as usual, with something more or less remote from our ideal, and take historians of science as they are. However, and this is my main point, historical shortcomings are on the whole far less dangerous than the purely scientific ones. A sound comprehension of the subject is the very heart of our studies, for what interest could we have in the history of a scientific idea, however accurate, if the idea itself was misconstrued? Of the two kinds of historians of science, those who were primarily trained as historians, and those who received a purely scientific training, we may assume a priori that the latter are the better.

« This Puzzling Planet » is an attempt, and on the whole a very successful one, to explain the main theories of modern geology in as simple a language as possible. An introductory chapter « Shepherd against sailor » shows why geology was born in Greece, and not in Palestine

or in Mesopotamia; the reasons of this were not simply psychological, but geological. Greece was a country which invited geological speculation, while the alluvial plains of Mesopotamia discouraged it. The titles of the following chapters are sufficiently clear, for him who knows, to require further comment.

(2) This North America of ours; (3) The geology of common sense; (4) The flood theory of fossils; (5) The onion-coat earth; (6) The divisions of geologic time; (7) Where the fossils come in; (8) What is inside the earth; (9) The lesson of the earthquake wave; (10) Continents adrift; (11) Faults, earthquakes, and rift valleys; (12) The making of mountains; (13) Faults and folds; (14) The carving of the landscape; (15) Ice-ages, old and new; (16) The chronology of an ice age; (17) The climates of geologic time; (18) Life without fossils; (19) The beginnings of the world.

The intelligent reader who will take the trouble to peruse this book carefully (for being a worthwhile book it cannot be read without effort) will have a very good introductory knowledge of the development of geology and of its main problems: glacial theory, WEGENER theory, isostasy, tectonics, seismology, absolute chronology, palaeogeography and palaeoclimatology, etc., etc. To give a more concrete idea of it, I shall quote a few passages which struck me as particularly felicitous.

It was a good idea to insist that the palaeontological method of determining the relative chronology of strata was considerably anterior to the theory of evolution. It is well to remember that « of the four main lines of evidence for evolution in the animal kingdom, three were supplied with convincing data by persons who did not accept the theory. »

What makes an Ice Age is not cold winters, but cool summers. « There is no reason to suppose that the earth's average temperature during the last great Ice Age was more than about ten degrees colder than it is now. Ten degrees mean annual temperature is the difference between Sitka and Portland on one side of the continent, Cape Cod and Cape Hatteras on the other, Missouri and Louisiana in between. Not cold, but heavy snowfall, makes an Ice Age. A drop of three degrees would probably put back the glaciers of northern Scotland. » « The earth as a whole is growing neither cold nor hot. It simply alters back and forth, as from summer to winter and day to night, without really getting anywhere. Climatic change, also, exhibits 'no trace of a beginning and no prospect of an end.' (*) That, too, is 'uniform.' »

The account of seismology is good too, though it would have deserved more development. In this and all related questions, the author has followed REGINALD ALDWORTH DALY of Harvard (*Isis*, 10, 286), — a safe guide. The making of mountains is clearly explained, and a fair

(*) See *Isis*, 2, 360, pl. 2.

tribute is paid to the main pioneer of these studies, PETER SIMON PALLAS. « The important point is that all the great ranges of the world, and most of the small ones as well, have been compressed from side to side. » « The thrust that makes the mountain range comes from one side only, not from both — from the south for the Alps and Himalayas; from the southeast for the Appalachians. » « It all looks very much as if the Pacific Basin were a low spot on the earth; and all the land on earth were sliding down into it from all sides. »

To illustrate the newness of scientific geology, BREWSTER recalls an amusing anecdote relative to ADAM SEDGWICK's election to the Woodward chair in Cambridge, 1818 (mark the date, 1818) : « So SEDGWICK became a candidate — against a large field, for the Woodwardian Professorship at Cambridge was even then an academic prize. He won hands down, being obviously by far the best qualified man. His nearest rival, as SEDGWICK said',... had not the slightest chance against me, for I knew absolutely nothing of geology, whereas he knew a good deal — but it was all wrong.' »

In the course of my reading I came across a few historical errors, which ought to be corrected in future editions. The tenth century Muslim, 'UMAR AL-'ALIM (p. 50, 55), which the author found in LYELL's *Principles*, is, I believe, a ghost; if not, he did not live as early as LYELL says (See my *Query* 12, in this journal). HORACE BENEDICT DE SAUSSURE was not the first man, but the third, to ascend Mont Blanc. The first ascent was made by PIERRE BALMAT and MICHEL GABRIEL PACCARD on August 8, 1786; SAUSSURE's ascent occurred on August 3, 1787 (*Isis*, 6, 67). It is not correct to say that the first geological map was made by WILLIAM SMITH in 1799, and the first geological map of America, by WILLIAM MACLURE in 1809; or at any rate these statements would need qualification. I have given in 1919 a list of early geological maps, including 9 anterior to WILLIAM SMITH. (*Isis*, 2, 369-371).

GEORGE SARTON.

Lucien Lévy Bruhl. — *Les fonctions mentales chez les sociétés inférieures.*

8^e éd. (III + 370 p.). Bibliothèque de philosophie contemporaine.

Paris, FELIX ALCAN. 1929 (frs. 40)

Raoul Allier. — *Les non-civilisés et nous, différence irréductible ou identité foncière.* 317 p. Paris, PAYOT, 1927 (frs. 25).

Olivier Leroy. — *La raison primitive.* Essai de réfutation du prélogisme. 316 p., 8 fig., 15 pl. Paris, GEUTHNER, 1927 (frs. 60).

La notoriété de l'œuvre de M. LÉVY BRUHL concernant la psychologie intellectuelle des peuplades improprement appelées sauvages ou primitives a dépassé largement le cercle restreint de spécialistes auxquels elle semblait tout d'abord adressée; elle n'intéresse plus seulement les ethnologues, les voyageurs et les fonctionnaires coloniaux; mais elle

est aussi utilisée et commentée à diverses occasions par les psychiatres, les pédagogues, les sociologues, les historiens, et les philosophes soucieux d'établir sur des bases solides la théorie de la connaissance scientifique. A ce titre elle ne saurait laisser indifférents les lecteurs d'*Isis* qui se souviennent de ses deux derniers ouvrages : *La mentalité primitive* (*Isis* 5, 467) et *L'âme primitive* (*Isis* 9, 482). La librairie FÉLIX ALCAN vient de rééditer le premier livre dans lequel l'auteur a abordé le sujet sur lequel il n'a pas cessé depuis de méditer : *Les fonctions mentales dans les sociétés inférieures* (paru en 1912); cette nouvelle édition ne diffère des précédentes que par l'adjonction d'un excellent index qui avait manqué jusqu'alors.

La doctrine de M. LÉVY BRUHL qu'il nous faut examiner ici a sans doute pu paraître quelque peu paradoxale; elle a cependant fini par s'imposer et cela avec une telle force que ses conclusions en ont semblé de l'aveu d'un ardent adversaire (LEROY, p. 13) définitivement acquises; ce grand succès même devait susciter nombres de critiques et d'objections. M. RAOUL ALLIER, dans un ouvrage intitulé : *Les non-civilisés et nous : différence irréductible ou identité foncière*, la combat avec mesure. M. OLIVIER LEROY a prononcé contre elle un sévère réquisitoire dans un livre d'ailleurs luxueusement présenté et orné de belles illustrations : *La raison primitive; essai de réfutation du prélogisme* (*Isis*, 11, p. 259).

A la lumière de cette controverse, il nous sera sans doute possible de faire un examen judicieux des théories de M. LÉVY BRUHL; d'indiquer peut être quels en sont les points douteux ou prêtant à discussion; mais aussi de mettre en relief ce qu'elles apportent de nouveau et de fécond concernant la connaissance de la marche de la pensée humaine.

Si la lecture des livres de M. LÉVY BRUHL a pu faire naître dans l'esprit de beaucoup d'entre nous un malaise qui ne se dissipe que lentement, cela tient à ce qu'il a heurté de front et dans la manière même dont il a posé le problème initial, une affirmation instinctive, spontanée et tenace; le point de départ de ses travaux fut en effet un doute concernant l'unité de l'esprit humain, unité qui avait toujours été admise comme allant de soi et qui d'ailleurs forme la trame des déductions de Sir JAMES FRAZER dans cet admirable monument qu'est le *Rameau d'or*. Contrairement donc à une semblable hypothèse qui, répétons le, nous agréait naturellement par sa simplicité et sa vraisemblance, M. LÉVY BRUHL s'est demandé si la mentalité de certaines races d'hommes ne différerait pas de la nôtre, (entendons de celle que nous croyons être la nôtre); il a cru pouvoir expliquer ainsi une foule de mœurs, de pratiques et de croyances étrangères qui avaient attiré l'attention étonnée des explorateurs et missionnaires fréquentant les peuplades sauvages; portant ses vues plus loin encore, il a tenté, en ramenant tous ces faits sous un point de vue unique, sinon de pénétrer entièrement la mentalité de ces hommes ap-

paremment si éloignés de nous, du moins de la deviner, de déterminer quelles sont ses réactions les plus caractéristiques.

Après une longue et minutieuse enquête, M. LÉVY BRUHL a établi que la pensée des primitifs toute encombrée d'émotivité et de mysticisme, fort peu capable d'abstraction ou d'analyse désintéressée, ne supporte pas dans un nombre considérable de cas le joug de nos axiomes logiques fondamentaux, notamment du principe de contradiction ! Cette mentalité, que faute d'un terme meilleur, l'auteur qualifie de *prélogique*, différerait de la nôtre en ce que la plupart de ses démarches seraient régies par une *loi de participation* qui permettrait d'affirmer une identité simultanément partielle et complète entre évènements et choses apparemment fort différents qui seraient cependant les mêmes; pour cette mentalité, en effet, « les objets, les êtres, les phénomènes peuvent être d'une façon incompréhensible pour nous à la fois eux mêmes et autre chose qu'eux mêmes. D'une façon non moins incompréhensible, ils émettent et ils reçoivent des forces, des vertus, des qualités, des actions mystiques qui se font sentir hors d'eux sans cesser d'être où elles sont ». (p. 77).

Que cette proposition d'allure étrange explique une foule d'exemples pittoresques qui dans l'œuvre de M. LÉVY BRUHL lui servent à la fois de soutien et d'illustration, c'est ce que nous révélerait la lecture des *fonctions mentales chez les sociétés inférieures*; la place nous manque ici pour suivre l'auteur dans ses recherches concernant les diverses langues parlées par les primitifs, leurs systèmes de numération, leurs croyances, leurs pratiques, leurs mœurs; signalons simplement ceci : « L'enfant nouveau né subit le contre-coup de tout ce que fait son père, de ce qu'il mange, etc...L'Indien à la chasse ou à la guerre est heureux ou malheureux, selon que sa femme restée dans son campement s'abstient ou non de tels aliments, de tels ou tels actes. » (p. 78).

Il nous faut maintenant remarquer avec M. RAOUL ALLIER que la proposition fondamentale de M. LÉVY BRUHL est tantôt fort modestement présentée comme une simple hypothèse de travail, tantôt plus dogmatiquement comme une loi désormais hors de discussion. Or quelle portée devons nous lui attribuer ? Allons nous la rejeter entièrement en la déclarant arbitraire et artificielle ? C'est ce que les critiques que nous avons nommés se sont bien gardés de faire. N'allant pas au fond du débat, dédaignant (ce qu'il faut regretter) d'attaquer de front la doctrine qu'ils combattent, afin de découvrir dans l'argumentation de l'auteur quelque tare difficilement perceptible qui en aurait vicié les conclusions, ils se sont contentés, en éparpillant leurs efforts en tous sens, de lui livrer une guerre d'escarmouches; ils n'ont pas nié la valeur de la documentation, l'exactitude des faits qui ont servi à M. LÉVY BRUHL de matériaux de construction; seulement, avec M. OLIVIER LEROY, ils

ont prétendu que l'enquête préliminaire avait été partielle et incomplète; menée avec une idée préconçue, cette enquête n'aurait pas présenté sous une lumière égale tous les traits de la vie, des mœurs et de la mentalité des sauvages; elle n'aurait signalé qu'une partie des ressources mises en jeu par le développement de la pensée primitive; en la contemplant entièrement, en n'oubliant pas une partie de ses richesses, l'on verrait, suivant les critiques, que la psychologie intellectuelle dans les sociétés dites inférieures, diffère beaucoup moins de la nôtre qu'il n'aurait semblé tout d'abord.

Qu'y a-t-il donc à retenir des diverses critiques adressées à M. LÉVY BRUHL? Reconnaissons d'abord que le terme même de *primitif* — adopté sans idée préconçue par l'auteur et aujourd'hui d'usage courant — appelle dans l'esprit de maint lecteur une hypothèse évolutionniste, sans doute arbitraire, que M. OLIVIER LEROY dénonce expressément (p. 16 à 23) : d'après laquelle nos sauvages d'aujourd'hui auraient atteint un stade de développement tout à fait comparable à celui des ancêtres lointains de l'humanité civilisée actuelle. Il suffit, semble-t-il, de signaler qu'il n'y a là qu'une querelle de mots, pour dissiper au moins partiellement le malentendu qu'elle a fait naître.

Reconnaissons aussi que les nombreux exemples cités par M. LÉVY BRUHL à l'appui de sa thèse ont été en effet soigneusement choisis en vue de l'utilisation de leur force démonstrative; — mais demandera-t-on immédiatement, dans une œuvre semblable à la sienne aurait-il pu en être autrement? Toujours est-il que contrairement à ce que l'on croit bien souvent, l'auteur des *fonctions mentales chez les sociétés inférieures* n'a pas prétendu décrire entièrement la vie et les mœurs des peuplades sauvages; après avoir lu ses ouvrages, l'on pourrait ignorer que la plupart des sorciers qui terrorisent les villages sont véritablement des êtres dangereux, puissants et malfaisants (LEROY, chap. V 117) l'on pourrait ignorer encore — je parle d'après M. LEROY (p. 147 et suiv.) — que la magie telle qu'elle est pratiquée chez les peuples nègres aboutit parfois à des divinations si surprenantes d'exactitude que bien des missionnaires doués de sens critique aiguisé sont restés hésitants quant à la valeur des procédés employés.

Reconnaissons ensuite que M. LÉVY BRUHL a négligé de signaler les nombreux cas relevés par M. LEROY où les sauvages ont fait preuve d'une intelligence qui nous paraîtrait normale; cette omission — ajoutons le — a été volontaire, puisque ces dits exemples n'apportaient aucune lumière à la question primordiale qu'il s'était proposé de résoudre : Dans quels cas et comment la pensée des primitifs peut-elle s'engager dans des voies qui paraissent étrangères à celle que suit notre pensée logique?

Reconnaissons enfin avec M. RAOUL ALLIER qu'il ne serait pas difficile de déceler chez les civilisés de nombreuses croyances, raisonnements

et pratiques basés sur l'admission souvent inconsciente de *participations prélogiques*. M. LÉVY BRUHL, il est vrai, a bien consacré quelques pages à la *persistance des éléments prélogiques* (p. 450, 454) dans notre mentalité; peut-être n'a-t-il pas aperçu immédiatement que ces dits éléments constamment combattus et refoulés par la critique véritablement logique forment encore aujourd'hui un des ressorts les plus importants et les plus efficaces de notre pensée elle-même.

En définitive, il nous faudra accorder à MM. LEROY et ALLIER qu'il n'existe aucun abîme infranchissable entre la pensée des primitifs et la nôtre; loin que ces mentalités soient foncièrement hétérogènes, elles ne diffèrent pour ainsi dire que de degrés; la notion instinctive de l'unité de l'Esprit humain n'a, semble-t-il, pas été atteinte par les travaux de M. LÉVY BRUHL; faudrait-il donc proclamer avec quelques polémistes que l'œuvre de ce dernier serait inutile et vaine? A notre avis une telle conclusion laisserait échapper l'essentiel de ce que le livre que nous analysons a apporté de nouveau. De même que les chimistes ont découvert l'hélium dans le soleil avant de le découvrir sur la terre, l'auteur en étudiant les sauvages a, par un détour long et inattendu, mis en lumière un effet constant des démarches de notre intelligence qui avait échappé jusqu'alors aux psychologues les plus perspicaces. Ainsi que l'avaient pressenti savants et philosophes mystiques qui ne sont, il faut le dire, jamais parvenus à s'expliquer clairement, la logique ne serait pas l'instrument de la pensée, mais, de la vérification; c'est parce que ce besoin de la vérification est très faible chez le primitif et qu'il ne masque pas chez lui le mouvement spontané de l'esprit, que M. LÉVY BRUHL a pu observer dans toute sa force le jeu de la *loi de participation*, que la réflexion critique ne tolère que péniblement; mais il serait possible de montrer que, quoique plus faiblement, cette même loi joue aussi ailleurs : l'étude de la formation des hypothèses scientifiques notamment nous révélerait sans doute que le chercheur fait constamment effort pour échapper aux contradictions imposées par des *participations* inaperçues, dissimulées dans les prémisses; ainsi, en s'engageant dans la voie nouvelle ouverte par M. LÉVY BRUHL, l'historien des sciences pénétrerait avec plus de facilité et de sympathie dans les doctrines des savants anciens dont une partie des fondements lui avait paru au premier abord étranges ou inaccessibles.

(Paris)

HÉLÈNE METZGER.

Twenty Fifth Critical Bibliography

of the

**History and Philosophy of Science and of the History
of Civilization**

(to October 1928)

This Twenty Fifth Bibliography contains about 661 items, some of which have been kindly contributed by the following scholars :

T. L. DAVIS (Cambridge, Mass.)	H. METZGER (Paris)
L. GUINET (Brussels)	J. NEEDHAM (Cambridge)
J. W. S. JOHNSON (Copenhagen)	QUIDO VETTER (Prague)
E. KREMERS (Madison, Wisc.)	H. WIELEITNER (Munich)
J. K. WRIGHT (New York)	

This bibliography includes a complete analysis of volume 10, and the seventh series of addenda and errata to Volume I of my *Introduction to the History of Science* (Baltimore and London, 1927). An author's index will be found at the end.

Papers and books sent to the Editor are entered into this bibliography if they are relevant to its purpose. They may be the object of analytical notes or longer reviews, if this seems sufficiently necessary and the services of competent scholars are available. It is obvious that only a small number of publications can be adequately reviewed and that it is not even possible to give a brief description of each and every one. However, our classification is so comprehensive and so minute, that even if we do nothing but give the accurate title of an item and put it in its proper place, we are already rendering a real service to the author, the publisher and the learned public. It should also be noted that there is no relation between the importance of a publication and the length of the note devoted to it.

The ultimate aims of this undertaking are : (1) to establish the History of Science as an independent discipline; (2) to demonstrate inductively the Unity of Knowledge and the Unity of Mankind; (3) to serve as a center of information and rallying ground to the scholars engaged in our studies.

*Harvard Library, Room 185.
Cambridge, Massachusetts.*

GEORGE SARTON.
November 23, 1928.

PART I.

FUNDAMENTAL CLASSIFICATION (CENTURIAL).

Vth Century B. C.

Luria, S. PROTAGORAS und DEMOKRIT als Mathematiker. *Comptes Rendus de l'Académie des Sciences de l'URSS*, 74-79, 1928. ISIS

Meritt, Benjamin Dean. 'The Athenian calendar in the fifth century, based on a study of the detailed accounts of money borrowed by the Athenian state, I. G. I², 324. (Published for the American School of Classical Studies at Athens) 138 p., 2 pl. Cambridge, Harvard University Press, 1928. ISIS

Reviewed by A. B. W., *American Historical Review*, 34, 99-101, 1928.

IVth Century B. C. (whole and first half).

Körte, Alfred. Aufbau und Ziel von XENOPHONS Symposium. (*Ber. über d. Verh. der Sächs. Akad. der Wiss. zu Leipzig, Philol.-hist. Kl.*, 79. Bd.) 48 S. Leipzig, HIRZEL, 1927. ISIS

Reviewed by TH. HOPFNER, *Deutsche Literaturzeitung*, 1594-96, 1928.

Müller, Friedrich. Stilistische Untersuchung der Epinomis des PHILIPPOS VON OPUS. *Philolog. Dissert.* 73 p. Berlin, 1927. ISIS

Reviewed by GIORGIO PASQUALI, *Deutsche Literaturzeitung*, 1217-1218, 1928.

(Plato) *Introduction*, vol. I, p. 115. Add to the bibliography relative to the Nuptial Number the following. HERMANN VOLLRAT HILPRECHT: Mathematical, metrological, and chronological tablets from the Temple Library of Nippur (The Babylonian Expedition of the University of Pennsylvania, Series A, Cuneiform texts, vol. XX, 1. p. 29-34, Philadelphia 1906). QUIDO VETTER.

ISIS

IVth Century B. C. (second half).

Suys, Emile. Vie de PÉTOSIRIS. Grand prêtre de THOT à Hermopolis la-Grande. Avec une préface de JEAN CAPART. 158 p., 6 pl. Bruxelles Edition de la Fondation Egyptologique Reine Elisabeth, 1927. ISIS

Compte rendu populaire fort bien écrit des découvertes de GUSTAVE LEFEBVRE publiées par lui dans son *Tombeau de Pétosiris* (3 vols.; Le Caire, 1923-24). G. S.

Vogliano, Achille. Nuove Lettere di EPICURO e dei suoi scolari. 41 p., 5 pl. Bologna, Stabilimenti poligrafici riuniti, 1928. ISIS

Reviewed by U. VON WILAMOWITZ-MOELLENDORFF, *Deutsche Literaturzeitung*, 1157-1158, 1928.

IIIrd Century B. C. (whole and first half).

Heath, Sir Thomas L. The thirteen books of EUCLID's Elements. Translated from the text of HEIBERG. With introduction and commentary. 3 vols. I. Introduction and Books I, II. xii + 432 p, 1 pl. Vol. II. Books III-IX 436 p. Vol. III. Books X-XIII and appendix. Cambridge University Press, 1926. (New York, MACMILAN). ISIS
Reviewed by GEORGE SARTON, *Isis*, 10, 60-2, 1928.

Thomas-Stanford, Charles. Early editions of EUCLID's Elements. 64 p., 13 pl., London, Bibliographical Society, 1926. ISIS
Reviewed by R. C. ARCHIBALD, *Isis*, 10, 60, 1928.

IIIrd Century B. C. (second half).

Miller, G. A. ARCHIMEDES and trigonometry. *Science*, 67, 555, 1928 ISIS
Miller, G. A. The so-called sieve of ERATOSTHENES. *Science*, 68, 273, 1928. ISIS
Mookerji, Radhakumud. ASOKA (Gaekwad Lectures). xv + 273 p. London, MACMILLAN, 1928. ISIS

Ist Century B. C. (whole and first half).

McLean, R. C. LUCRETIUS's anticipation of Mendelism. *Nature*, 121, 749, 1928. ISIS
Schubert, Paul. Die Eschatologie des POSIDONIUS. (*Veröff. der Forsch.-Inst. für vergl. Religionsgesch. an der Univ. Leipzig*,) 100 p. Leipzig, PFEIPPER, 1927. ISIS
Reviewed by I. HEINEMANN, *Deutsche Literaturzeitung*, 5, 1709-10, 1928.

Ist Century after Christ (second half).

Wilson, Thomas, of Stow. St. Paul and paganism. (The Gunning Lectures, 1926). vii + 285 p. Edinburgh, T. AND T. CLARK, 1927. ISIS

IInd Century (whole and first half).

Tallgren, Oiva Joh. Survivance arabo-romane du catalogue d'étoiles de PTOLÉMÉE. Etudes philologiques sur différents manuscrits. I.

Introduction et Série première. Extrait de *Studia Orientalia*, editio Societas Orientalis Fennica, 2, 202-283, Helsingfors, 1928. ISIS

« Je me propose de comparer au texte grec de PTOLÉMÉE, pour une série de passages, d'abord, deux traductions arabes inédites et étudiées sur trois manuscrits, puis la traduction latine de GÉRARD DE CRÉMONE étudiée sur un manuscrit du XII^e siècle et, en dernier lieu, la traduction espagnole d'ALPHONSE X étudiée, en partie, sur tous les manuscrits connus de son *Astronomie*. Une fois terminée, l'étude comparée de ces manuscrits inédits nous permettra d'établir la filiation d'un certain nombre de malentendus d'ordre linguistique dont se ressent la tradition médiévale du Catalogue d'étoiles de PTOLÉMÉE, et de rectifier notamment une série d'erreurs commises en l'espèce par LUDWIG IDELER. Un certain nombre des notes qui suivent pourront offrir quelque intérêt au point de vue de la science des traductions en général. Tous ces travaux sont destinés à préparer une édition du texte d'ALPHONSE X ainsi que de la partie correspondante de l'*Almageste* arabe et de la traduction de GÉRARD, si importante celle-ci au point de vue de l'histoire de la science européenne. En outre, le cas échéant, je parviendrai à introduire des corrections dans le texte grec de PTOLÉMÉE tel qu'il apparaît dans la soignée édition de HEIBERG. »

IInd Century (second half).

Bernhard, Max. Der Stil des APULEIUS von Madaura. Ein Beitrag zur Stilistik des Spätlateins. (Tübing. Beiträge zur Altertumswiss., 2.) XII + 366 p. Stuttgart, W. KOHLHAMMER, 1927. ISIS

Reviewed by WILHELM BAEHRENS, *Deutsche Literaturzeitung*, 1305-1307, 1928.

Robinson, Herbert Spencer. GALEN in CHAUCER, SHAKESPEARE, and JONSON. *Medical Life*, 35, 445-50, illustr. 1928. ISIS

Walsh, Joseph. GALEN clashes with the medical sects at Rome. *Medical Life*, 35, 408-43, illus., 1928. ISIS

IIIrd Century (second half)

Bréhier, Emile. La Philosophie de PLOTIN. XX + 190 p., BOIVIN, Paris, 1928. ISIS

EMILE BRÉHIER, à qui on doit une édition complète, avec traduction, des *Ennéades* (v. *infra*, PLOTIN), publie un cours fait à la Sorbonne en 1921-22, sur « ce que PLOTIN appelle d'un nom d'ensemble l'intelligible », sur l'Un, l'Intelligence, et l'Ame, qui constituent le « cœur de la pensée de PLOTIN. » — 1. Le troisième siècle de notre ère; 2. les *Ennéades*; 3. le problème fondamental de la philosophie de PLOTIN; 4. la procession; 5. l'Ame; 6. l'Intelligence; 7. l'orientalisme de PLOTIN; 8. l'Un; 9. Conclusion.

Plotin. *Ennéades*. IV. Texte établi et traduit par EMILE BRÉHIER. Collection des universités de France. 472 p., *Les Belles Lettres*, Paris, 1927. ISIS

Les deux premiers volumes de cette édition, ou les notes de BRÉHIER sont infiniment précieuses, ont été signalées au tome 7 de cette revue, p. 534. Celui-ci comprend tous les écrits de PLOTIN sur l'âme (*V. supra* : BRÉHIER).
L. G.

Waldschmidt, Ernst; Lentz, Wolfgang. Die Stellung JESU im Manichäismus. (*Abhandl. der preuss. Ak. der Wiss.*, 1926, *Phil.-hist. Klasse*), 131 p., 4 pl. Berlin, 1926. ISIS

Reviewed by PAUL PELLIOU, *T'oung pao*, 25, 426-435, 1928.

IVth Century (whole and first half).

Eusebios, Bishop of Caesarea. The ecclesiastical history and the martyrs of Palestine. Translated with introduction and notes by H. J. LAWLOR and J. E. L. OULTON. Vol. II., introduction, notes and index. London, S. P. C. K., 1928. ISIS

IVth Century (second half).

Oribasios. *Collectionum medicarum reliquiae*. I, Libri I-VIII edidit J. RAEDER. (*Corpus medicorum Graecorum* VI, 1, 1) VIII + 300 p. Leipzig, TEUBNER, 1928. ISIS

Tucci, Giuseppe. Is the Nyayapravesa by DINNAGA? *Journal Royal Asiatic Society*, 7-13, 1928. ISIS

Tucci, Giuseppe. On the Fragments from DINNAGA. *Journal Royal Asiatic Society*, 377-390, 1928. ISIS

Vth Century (whole and first half).

(**Pelagius**). PELAGIUS's Expositions of thirteen epistles of ST. PAUL. Text and apparatus criticus by ALEXANDER SOUTER. (Texts and Studies, edited by J. A. ROBINSON, Vol. 9). 553 p. Cambridge, University Press, 1926. ISIS

Reviewed by ADOLF DEISSMANN, in *Deutsche Literaturzeitung*, 997-1000, 1928.

Vth Century (second half).

Gānguli, S. K. Notes on ĀRYABHATA. 1. ĀRYABHATA's rules for the extraction of square and cube roots; 2. ĀRYABHATA's value of pi; 3. ĀRYABHATA's inaccuracies; 4. ĀRYABHATA's solution of quadratic equations; 5. The Greek rule epanthema. Reprinted from the *Journal of the Bihar and Orissa Research Society*, 78-91, Patna, 1926. ISIS

Gānguli, Sāradākānta. Was ĀRYABHATA indebted to the Greeks

for his alphabetic system of expressing numbers? *Bull. Calcutta Math. Soc.*, vol. 17, no. 4, 195-202, 1928.

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« ĀRYABHAṬA's alphabetic scheme had an orderly growth in India. As a result of the application of the three tests laid down by Mr. KAYE, we are forced to the conclusion that ĀRYABHAṬA is not indebted to a foreign source for his alphabetic system of expressing numbers. »

Vth Century (second half)

Jones, Putnam Fennell. The Gregorian mission and English education. *Speculum*, 3, 335-348, 1928.

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VIIth Century (whole and first half).

Nöldeke, Theodor. Geschichte des Qorâns. 2. Aufl. III. Teil : Die Geschichte des Qorantexts. 80 S. Von G. BERGSTRÄSSER, Lieferung I. Leipzig, DIETERICH, 1926.

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Reviewed by R. HARTMANN, *Der Islam*, 272-74, 1927.

VIIIth Century (second half).

Ruska, Julius. JĀBIR IBN ḤAJJĀN und seine Beziehungen zum imām JA'FAR AS-ŠĀDIQ. *Der Islam*, 16, 264-66, 1927.

ISIS

Ruska, Julius. Das Giftbuch des JĀBIR IBN ḤAJJĀN, *Orientalistische-Literaturzeitung*, Sp. 453-56, 1928. (not seen)

ISIS

IXth Century (whole and first half)

Brögger, A. W.; Falk, Hj.; Schetelig, Haakon. Osebergfundet. With a summary in English. Bind I., av A. W. BRÖGGER, W. C. BRÖGGER, JENS HOLMBOE, HAAKON SCHETELIG. Bind III., av HAAKON SCHETELIG. XII + 413 p., 27 pl., VIII + 439 p. Kristiania, Universitetets Oldsaksamling, 1917, 1920.

ISIS

Reviewed by WALDEMAR WESTERGAARD, *American Historical Review*, 33, 850-1, 1928.

(Ibn Saad). Biographien MUHAMMEDS, seiner Gefährten, und der späteren Träger des Islams bis zum Jahre 230 der Flucht. Herausgeben von EDUARD SACHAU. In nine volumes. Leiden, E. J. BRILL, 1905-1928.

ISIS

Reviewed by D. B. MACDONALD, *American Historical Review*, 34, 154, 1928.

IXth Century (second half).

Farmer, Henry George. IBN KHURDĀDHBĪH on musical instruments. *Journal of the Royal Asiatic Society*, 509-518, 1928.

ISIS

(al-Jāhiz). Three essays of ABŪ 'OTHMAN 'AMR IBN BAHR AL-JĀHIZ (d. 869). Edited from three manuscripts, with introductions by JOSHUA FINKEL. 78 p. (all in Arabic). Cairo, Salafyah Press, 1344 (1926).

ISIS

Reviewed by GEORGE SARTON, *Isis*, 10, 494-5, 1928.

(al-Ṭaḥāwī). Das Kitāb adhkar al-ḥuqûq war-ruhûn aus dem al-jâmi' al-kabîr fîsh-shurûṭ des ABŪ JA' FAR AḤMAD IBN MUḤAMMAD AL-ṬAḤĀWÎ hrsg. von JOSEPH SCHACHT. (*Sitz.ber.d. Heidelberg. Akad. d. Wiss., philos.-hist. Kl.*, Jg. 1926-7, 4. Abhlg.) VIII + 42 p. Heidelberg, CARL WINTER, 1927.

ISIS

Reviewed by WILHELM HEFFENING, *Deutsche Literaturzeitung*, 953-55, 1928

Xth Century (whole and first half).

al-Mu'tazilî, Abû'l-Ḥusain 'Abdarrāḥîm ibn Muḥammad ibn 'Othmân al-Khaijat. Kitāb al-intiṣār wal-radd 'alâ IBN AL-RAWENDI al-Mulhid. Le livre du triomphe et de la réfutation d'IBN ER-RAWENDI l'hérétique. Texte arabe publié pour la première fois d'après le manuscrit unique conservé dans la Bibliothèque Egyptienne du Caire avec une introduction, des notes et des index par H. S. NYBERG. LXVI + 252 p. Le Caire, Imprimerie de la Bibliothèque Egyptienne, 1344/1925.

ISIS

Reviewed by R. STROTHMANN, *Der Islam*, 16, 280-3, 1927.

Plessner, Martin. Der Inhalt der nabatäischen Landwirtschaft. Ein Versuch, IBN WAḤSHĪJA zu rehabilitieren. *Zeitschrift für Semitistik und verwandte Gebiete*, 6, 27-56, 1928.

ISIS

Xth Century (second half.)

Maslama ibn Aḥmad (*Introduction*, vol. I, 668). MASLAMA's version of PTOLEMY's Planisphere was translated by HERMANN THE DALMATIAN, rather than by RUDOLPH OF BRUGES. See my vol. 2. G. S.

ISIS

Murasaki, Lady. Blue trousers : Being the fourth part of « The tale of Genji. » Translated from the Japanese by ARTHUR WALEY. 333 p. London, ALLEN and UNWIN, 1928.

ISIS

XIth Century (whole and first half).

Capparoni, Pietro. Il « De Quattuor humoribus corporis humani » di ALFANO Arcivesco di Salerno (Sec. XI). Trascrizione del Codice Vallicelliano F. 86 (no. 10), annotazioni e commento, tavole e ripro-

duzione in fac-simile del testo. Prefazione del Prof. ARTURO CASTIGLIONI. 27 p., 3 pl., facs. Roma, Istit. Naz. Med. Farmacol. « Serono », 1928. ISIS

Reviewed by HABERLING, *Mitteilungen zur Geschichte der Medizin und Naturwissenschaften*, 27, 338, 1928.

Meyerhof, Max. An Arabic compendium of medico-philosophical definitions. *Isis*, 10, 340-9, 1928. ISIS

Apropos of Al-rauḍa al-tibbiyya of 'UBAID ALLĀH IBN JIBRĪL IBN BAKH-TYASHŪ' (SARTON, vol. 1, 730).

Schoy, Carl (1877-1925). Die trigonometrischen Lehren des persischen Astronomen ABŪ L-RAIHĀN MUḤ. IBN AḤMAD AL-BĪRŪNĭ dargestellt nach al-Qânûn al-Mas'ûdî. Nach dem Tode des Verfassers herausgegeben von JULIUS RUSKA und HEINRICH WIELEITNER. XII + 108 p., 50 fig. Hannover, HEINZ LAFAIRE, 1927. (Mk. 16) ISIS

Reviewed by GEORGE SARTON, *Isis*, 10, 495-7, 1928.

XIth Century (second half).

Bidez, Joseph. MICHEL PSELLUS. Epître sur la Chrysopée. Opuscules et extraits sur l'alchimie, la météorologie et la démonologie. En appendice, PROCLUS sur l'art hiératique. PSELLUS. Choix de dissertations inédites (Catalogue des manuscrits alchimiques grecs, 6). XIV + 246 p. Bruxelles, LAMERTIN, 1928. ISIS

This volume is almost entirely devoted to PSELLOS, and contains critical editions of a number of his writings. See my review in *Isis*, 12, 165-8. G. S.

al-Ghazzālī. Tahafot al-falasifat. Texte arabe établi et accompagné d'un sommaire latin et d'index, par MAURICE BOUYGES, S. J. XXX + 448 p. Beyrouth, Imprimerie Catholique, 1927. ISIS

Reviewed by DUNCAN B. MACDONALD, *Isis*, 10, 497-99, 1928.

Salet, Pierre. OMAR KHAYYAM savant et philosophe. 165 p. Paris, Librairie MAISONNEUVE, 1927. (15 frs.) ISIS

Reviewed by H. D., *Journal des Savants*, 295-96, 1928

Somadeva. The ocean of story. Being C. H. TAWNEY's translation of SOMADEVA's Kathâ Sarit Sâgara. Edited with introduction, fresh explanatory notes, and terminal essay, by N. M. PENZER. Vol. VIII. XXXV + 361 p. London, CHAS. J. SAWYER, 1927. ISIS

Reviewed by JARL CHARPENTIER in *Journal of the Royal Asiatic Society*, 679-681, 1928.

Theobald (Dr. Ing.). Was sagt uns die Schedula diversarum artium

.. (2) TO XIIth CENT.

des THEOPHILUS presbyter? *Beiträge zur Geschichte der Technik und Industrie*, 16, 217-22, 321, 1926. ISIS

Summary of the technical contents of the *Schedula* of which the author has prepared a German translation as yet unpublished. See SARTON's Introduction (vol. 1, 763). G. S.

XIIth Century (whole and first half).

Efros, Israel. Studies in Pre-Tibbonian philosophical terminology.

I. ABRAHAM BAR HIYYA, the Prince. *The Jewish quarterly review*, 17, 129-164, 323-368, 1926-1927. ISIS

This study aims to present the various philosophical, mathematical, astronomical and calendrical terms (ancient and medieval philosophy drew no sharp line of demarcation between any of the above sciences, as is also shown by the variety of meaning of the term pilosofim) which ABRAHAM the son of HIYYA, a pioneer in the use of the sacred tongue for his meditations and investigations, employed in his chiefly ethical work *Itegyon ha-nefesh*, in his geometrical work *Sefer ha-meshihah weha-tishboret* (at the end of which GUTTMANN has an inadequate list of terms), and in his calendrical work *Sefer ha-'ibbur*, in his astrological and eschatological work *Megillat ha-megalleh*, and in his astronomical work *Surat ha-aref*. It will aid us, together with subsequent studies in pre-Tibbonian terminology, in determining with some exactness the debit and credit accounts of the great translators. Interesting is the fact that SAMUEL IBN TIBBON himself did not seem to be fully aware of the whole extent of his debt.

Gânguly, Sâradâkânta. BHÂSKARÂCHÂRYA and simultaneous indeterminate equations of the first degree. *Bulletin of the Calcutta mathematical society*, 17, 89-98, 1926. ISIS

« We conclude that BHÂSKARÂCHÂRYA considered the general case of simultaneous indeterminate equations of the first degree, which might be stated thus :

$$a_1 x \pm c_1 = b_1 y, \quad a_2 x \pm c_2 = b_2 z, \quad a_3 x \pm c_3 = b_3 w, \text{ etc.}$$

and that he gave the rule quoted above for its solution. »

Gânguly, Sâradâkânta. BHÂSKARÂCHÂRYA's references to previous teachers. *Bull. of the Calcutta mathematical society*, 18, 65-76, 1927. ISIS

« The object of this paper is not to disprove the foreign origin (if any) of Indian mathematics. The fact that BHÂSKARÂCHÂRYA referred to Indian mathematicians only cannot, by itself, establish indigenous origin. »

Haskins, Charles Homer. The renaissance of the twelfth century.

XI + 437 p. Cambridge, Harvard University Press, 1927. ISIS

Reviewed by GEORGE SARTON, *Isis*, 10, 62-5, 1928.

Steele, Robert and Singer, Dorothea Waley. The Emerald Table.

Reprinted from the *Proceedings of the Royal Society of Medicine*, 21, (Section of the History of Medicine, p. 41-57), 1928. ISIS

« The subject of our paper is a translation made, probably early in the twelfth century, from an Arabic collection of explanations and commentaries on a document known as the Emerald Table of HERMES. The translation we publish is met with in Latin, sometimes as a whole, sometimes in extracts, and its publication is intended to be a supplement to the masterly study of the Emerald Table in its Arabic and Latin forms recently made by Professor RUSKA... »

« Our text is anonymous, but we identify the translator, with some hesitation, as PLATO OF TIVOLI, one of the earliest to make versions from the Arabic. His known works fall in the second quarter of the twelfth century (1134-45). Our reasons for this supposition are the style, which is very like that of his previously known writings, and seems very early, and that the translator speaks of the work as 'ante ab omni latinitate intractata,' an expression pointing to early work. As an entirely different version of a similar Arabic text was made about the same period by HUGO SANCTALENSIS, the claim of being the first translation must imply an early date. A further consideration is that our translation has slightly Hebraized forms of Arabic names, since we know that PLATO was assisted in his versions by the Jew, SAVASORDA. »

Carlyle, Sir R. W. and Carlyle, A. J. A history of mediaeval political theory in the west. Vol. 5. The political theory of the thirteenth century. xx + 494 p. Edinburgh, BLACKWOOD, 1928. ISIS

From the Preface : « It is now a little more than thirty-five years since we began this work, and this volume represents more or less what we then thought to produce, but we had not gone very far before we recognised that in order to understand the real character of the political theory of the Middle Ages it was necessary to go back for many centuries, especially to the Roman Jurists of the second century, and to the Christian Fathers, and even to make some examination of the political conception of the post-Aristotelian philosophy, from which both Jurists and Fathers derived some of their most important principles. We have in previous volumes therefore endeavoured to set out something of the history of mediaeval political theory, and to give their due weight to the various traditions out of which it arose, and by which it was influenced in varying degrees. In this volume we have endeavoured to set out the culmination of this long process of development in the thirteenth century.

« We hope to publish another volume dealing with the movements of political thought from the fourteenth to the sixteenth centuries — that is, during the period of the Renaissance — and to inquire what if any new conceptions of importance took their rise during these centuries, and thus to see more clearly how far modern political conceptions are continuous with those of the Middle Ages. »

Haskins, Charles H. The « alchemy » ascribed to MICHAEL SCOT. *Isis*, 10, 350-9, 1928. ISIS

Powicke, Frederick Maurice. STEPHEN LANGTON (d. 1228). Oxford, Clarendon Press, 1928. ISIS

XIIIth Century (second half).

- (Bacon, Roger). Opera hactenus inedita ROGERI BACONI fasc. IX. De retardatione accidentium senectutis. Cum aliis opusculis de rebus medicinalibus. Nunc primum ediderunt A. G. LITTLE, E. WITHINGTON. XLIV + 224 p. Oxford, Clarendon Press, 1928. ISIS

Blondheim, David Simon. An old Portuguese work on manuscript illumination. *Jewish Quarterly Review*, 19, 97-135, 1928. ISIS

Hebrew text, with English translation and a few notes, of this treatise in 45 chapters, covering 20 pp. and in the MS. De Rossi 945 of the R. Biblioteca Palatina of Parma. A colophon at the end of the ninth opuscle in the Ms. states that it was finished by ABRAHAM B. JUDAH IBN HAYYIM at Loulé, Portugal, in 1262. However the present form of the text seems to date from a somewhat later period. At any rate it would be interesting to compare this Hebrew text with the Latin texts of the same kind. It deals with the usual subjects : How to make gold paint, excellent blue, rose color (e.g., with brazil wood), red lead, verdigris, carmine, vermilion; how to color bones, box-wood; of filed bones how to make chessmen; how to make glue, varnish, etc. G. S.

Davis, Tenney L. ROGER BACON's gunpowder and his secret wisdom. *Industrial and Engineering Chemistry*, 20, 772, etc., 1928; reprint, 6 p. ISIS

Graux, Lucien. Le docteur illuminé, roman. 419 p. Paris, FAYARD, 1927. ISIS
Biography of RAMON LULL in the form of a novel. G. S.

Thorndike, Lynn. ANDALÒ DI NEGRO, PROFACIUS JUDAEUS, and the Alphonsine Tables. (Query 8) *Isis*, 10, 52-56, 1928. ISIS

XIVth Century (whole and first half).

Asin, Miguel. Islam and the Divine Comedy. Translated and abridged by HAROLD SUNDERLAND, with an introduction by the DUKE OF BERWICK AND ALBA. XXVI + 295 p. London, MURRAY, 1926. ISIS
Reviewed by GEORGE SARTON, *Isis*, 10, 65-9, 1928.

Brun, Robert. Avignon au temps des papes : les monuments, les artistes, la société. 288 p., 8 pl. Paris, COLIN 1928. ISIS
Reviewed by MARCEL AUBERT, *Journal des Savants*, 371, 1928.

Ibn Faḍl Allāh al-'Umarī (1301-49). Masālik el absār fi mamālik el amṣār. I. L'Afrique, moins l'Égypte. Traduit et annoté avec une introduction et 5 cartes par MAURICE GAUDEFRY-DEMOMBYNES.

LXVIII + 284 p. (Bibliothèque des géographes arabes, vol. 2). Paris, GEUTHNER, 1927. (100 frs.)

ISIS

The appearance of this very careful translation of an important part of the Masâlik gives me an opportunity of drawing our readers' attention to this new collection of Arabic geographical texts. They are published in French translation under the direction of GABRIEL FERRAND, whose name is a scientific guarantee. The translator of the present text has added a very learned introduction (dealing mainly with the Almohade administration, ceremonial and chancery), abundant notes, index and five maps: Abyssinia, Tunis, Morocco, Marrakesh, Granada. A few other texts are translated in appendix for the sake of comparison. He needs no introduction to the readers of this journal, for two of his works have already been discussed, *La Syrie à l'époque des Mamelouks* (Paris, 1923; *Isis*, 6, 561) and *Le Pèlerinage à la Mekke* (Paris, 1923; *Isis*, 8, 209). FERRAND's collection will include not only the texts edited by M. J. DE GOEJE in his *Bibliotheca geographorum arabicorum* but also a few others, some of them as yet unpublished. Our every good wish to this great and useful undertaking!

G. S.

(Marsiglio of Padua). The Defensor pacis of MARSILIUS OF PADUA.

Edited by CHARLES WILLIAM PREVITÉ-ORTON. XLVII + 517 p., 5 pl. London, Cambridge University Press, 1928.

ISIS

Critical edition of this great classic of political literature, with notes, indexes, and introduction. The *Defensor pacis* was completed by MARSIGLIO on 24 June 1324, with the collaboration of JOHN OF JANDUN. «It is natural to ask whether the precise share of JOHN OF JANDUN can be detected in the composition. A definite answer, if at all possible, could only be given after a very thorough comparison of his own works with the *Defensor Pacis*; but it appears to me that his influence is more pervasive than local. The style of the book gives little help: it changes with the theme and the books used. When papal bulls are being answered it markedly echoes their phrases and indignant rhetoric, and JOHN XXII and CLEMENT V are refuted in their own manner; when the Latin ARISTOTLE is studied, its mannerisms appear. As JOHN OF JANDUN was a devout Aristotelian of sceptical and Averroistic tendencies, veiled in irony, he may come more to the surface in those few passages where Aristotelian transcription is more complete, the thought more abstract, and the tone sceptical. The main author had a paternal affection for his presbyterian system, his erastianism, and a passionate republicanism, which bursts out in rhetoric even in a passage on taxation. This main author seems to me to be MARSILIUS OF PADUA, bred in an Italian commune, hating the ecclesiastical powers which put it out of gear, and anxious to combine the sharply bounded and compact unitary State he loved with a kind of society of Christendom guided by its elected advisory General Council.»

G. S.

Thorndike, Lynn. The clocks of JACOPO and GIOVANNI DE' DONDI.

Isis, 10, 350-2, 1928.

ISIS

XIVth Century (second half).

Thomson, S. Harrison. Some Latin works erroneously ascribed to WYCLIF. *Speculum*, 3, p. 382-91, 1928. ISIS

XVth Century (whole and first half).

(**Hus, John**). *Tractatus Responsivus*. Edited by S. HARRISON THOMSON. XXXIV + 173 p. Princeton, Princeton University Press, 1927. ISIS

Vogts, Hans. *Hospital St. Nikolaus zu Cues*. 52 p., ill. Augsburg, Dr. B. FILSER, 1927. ISIS

XVth Century (second half).

Antz, E. L. Das Wasserwerk der Stadt Halle (1467). *Beiträge zur Geschichte der Technik und Industrie*, 12, 124-27, 1922. ISIS

Horwitz, Hugo Th. GIULIANO DA SAN GALLO (1445-1516). *Beiträge zur Geschichte der Technik und Industrie*, 16, 200-216, 29 fig., 1926. ISIS

« Obwohl GIULIANO DA SAN GALLO nicht in demselben Masse Universalgenie wie LEONARDO DA VINCI war, so erkennt man aus der vorliegenden Abhandlung doch, dass er als echter Renaissance-künstler seinen Fachgenossen in vielseitiger Begabung und Betätigung keineswegs nachstand. Von Haus aus Bildschnitzer, entwickelte er sich zu einem bedeutenden Architekten, Kriegsbaumeister und Militäringenieur, und wie hier dargelegt wurde, sind auch seine Zeichnungen, die in der Ausführung denen LEONARDO DA VINCI's oft gleichgestellt werden können, beachtenswert; einzelne von ihnen weisen sogar ganz eigenartige, selbst den Kenner der damaligen technischen Leistungen überraschende Konstruktionen auf, die sich bei anderen Meistern dieser Zeit nicht vorfinden. Wo sich jedoch solche Beziehungen feststellen liessen, wurde ihnen hier nach Möglichkeit nachgegangen und die gegenseitige Abhängigkeit der Entwürfe voneinander klarzulegen versucht. Um die Eigenart SAN GALLO's zu kennzeichnen, muss aber darauf hingewiesen werden, dass er vor allem als hervorragender Baukünstler der Renaissance Geltung besitzt, und dass er neben den technischen Darstellungen durch die vielen Zeichnungen von Bauten des alten Roms starke archäologische Neigungen bewiesen hat, die beispielsweise LEONARDO DA VINCI keinesfalls in diesem Ausmasse zeigte. »

Thorndike, Lynn. BISTICIUS (or BISTICHUS) of Florence. Reprinted from the *Romanic Review*, 19, 244-49, 1928. ISIS

« In the work of JOHN OF AREZZO addressed to LORENZO DE MEDICI on the relative importance of medicine and law, of which I treated in a previous number of this Journal, in a discussion of medical quacks in the city of Florence, reference was made to 'BISTICIUS, a silversmith of Florence, a man ignorant of letters' who 'suddenly became the leading physician in the whole city.' I have since found other estimates of this BISTICIUS, or BISTICHUS, which

are more favorable and also some examples of his own medical recipes.»

Leonardo da Vinci

Semenza, Guido. L'automobile di LEONARDO. *Archeion*, 9, 96-103, 1928. ISIS

Examen de deux dessins du *Codex atlanticus*, qui représentent l'un et l'autre un véhicule avec un système de roues dentées, lequel pourrait bien être une automobile avec son différentiel?
L. G.

XVIth Century (whole and first half).

A. — *Mathematics.*

Cajori, Florian. CIRUELO on the names «arithmetical» and «geometrical» proportions and progressions. *Isis*, 10, 362-66, 1928. ISIS

Apropos of PEDRO SANCHEZ CIRUELO: *Cursus quatuor mathematicarum artium liberalium* (Alcala, 1516).

B. — *Physical sciences and Technology.*

Johannsen, Otto. BIRINGUCCIO und seine Pirotechnia. *Beiträge zur Geschichte der Technik und Industrie*, 16, 153-161, 3 fig., 1926. ISIS

C. — *Natural Sciences.*

Boyce, Helen (—1920). The mines of the Upper Harz from 1514 to 1589 (*Diss.*, Chicago; 130 p.; Menasha, Wisconsin, 1920). ISIS

Based upon Die Bergchronik des HARDANUS HAKE, Pastors zu Wildemann, edited by H. DENKER of Osnabrück (Wernigerode, 1911). HAKE's chronicle of the Upper Harz mines covers the years 1505 to 1583. The author has added a brief survey of German mining and of the Harz mines. The history of the latter falls into two periods. «The first was closed by the Black Death (1347); from that time the mines lay idle for more than a hundred years before work was recommenced in the late fifteenth century. Though there is no historical continuity between the two periods, the inclusion of the earlier one seemed justified by the demands of the subject as well as by the plan of HAKE's chronicle on which this study was based.» G. S.

Doesborch, Jan van. (Antwerp, about 1520). De novo mondo. Edited with transcription and translation of the Latin text and introduction by M. E. KRONENBERG. The Hague, MARTINUS NIJHOFF, 1928. ISIS

«Facsimile of an unique broadsheet containing an early account of the inhabitants of South America together with a short version of HEINRICH SPRENGER's Voyage to the Indies.»

Stevens, Henry N. The first delineation of the New World and the first use of the name America on a printed map. An analytical com-

parison of three maps for each of which priority of representation has been claimed (two with name America and one without). With an argument tending to demonstrate that the earliest in each case is the one discovered in 1893 and now preserved in the John Carter Brown Library at Providence, R. I. xvi + 127 p., facs. London, HENRY STEVENS, Son and STILES, 1928 (three guineas). ISIS

This splendid publication is enriched by two facsimile maps (a) the Stevens-John Carter Brown map, to which it is specially devoted, (b) the 1513 PTOLEMY maps, *Orbis typus universalis*.

It is divided into three parts, the first of which is devoted to proving that the first of these maps is the prototype of the *Orbis Typus* in the 1513 PTOLEMY; that it was designed and prepared by WALDSEEMÜLLER and his confrères of the Gymnase at St. Dié probably as early as 1505: that it was engraved at Nuremberg and printed there, probably as early as 1505, with Nuremberg type-letterings on Nuremberg paper; that it is in all probability the first specimen or experimental design made for the series of maps which the St. Dié cartographers intended adding to their proposed new edition of PTOLEMY, which we know was in active preparation at that time; that it is the first printed map yet known to show any part of the New World discoveries; that it is the first printed map on which the New World discoveries are marked with the name America.

In the second part, the author offers evidence to show that map (a) is anterior to the large WALDSEEMÜLLER map of 1507 discovered by JOSEPH FISCHER at Wolfegg castle in 1901.

In the third part, he argues that it is also anterior to the G. M. CONTARINI map of 1506, discovered in the British Museum, and published by the Museum in 1924, second ed., 1927, (*Isis*, 7, 205, 206, 544; 10, 146). G. S.

Varthema, Ludovico di. The itinerary of LUDOVICO DI VARTHEMA of Bologna from 1502 to 1508. As translated from the original Italian edition of 1510 by JOHN WINTER JONES in 1863 for the Hakluyt Society with a discourse on VARTHEMA and his travels in southern Asia by Sir RICHARD CARNAC TEMPLE. LXXXV + 121 p. London, Argonaut Press, 1928. ISIS

D. — Medical Sciences.

Dawson, Percy M. The heritage of PARACELSUS. *Annals of Medical History*, 10, 258-69, 1928. ISIS

Negker, Jost de. Die anatomischen Tafeln des JOST DE NECKER 1539. Hrsg. von KARL SUDHOFF und MAX GEISBERG. 6 S., Folio, 6 Taf., 2 Abb. München, SCHMIDT, 1928. ISIS

Paracelsus. Medizinische, naturwissenschaftliche und philosophische Schriften, hrsg. von KARL SUDHOFF. Zehnter Band: Die grosse Wund-arznei und anderes Schriftwerk des Jahres 1536 aus Schwaben und

Bayern. XLVIII + 688 S., 16+32 Abb. München, OLDENBOURG, 1928. ISIS

Reviewed by KARL SUDHOFF, *Mitteilungen zur Geschichte der Medizin*, 27, 196, 1928.

Paracelsus. Sämtliche Werke nach der 10 bändigen Huserschen Gesamtausgabe (1589-1591). Zum erstenmal in neuzeitliches Deutsch übersetzt, mit Einleitung, Biographie, Literaturangaben und erklärenden Anmerkungen versehen von BERNHARD ASCHNER. Zweiter Band, 910 S. Jena, FISCHER, 1928. ISIS

(**Pharmacopoeia Augustana**). A facsimile of the first edition of the *Pharmacopoeia Augustana*. With introductory essays by THEODOR HUSEMANN. (Publications of the State Historical Society of Wisconsin, Hollister Pharmaceutical Library, No. 1). Madison, 1927. ISIS

Reviewed by GEORGE SARTON, *Isis*, 10, 69-71, 2 pl., 1928.

Szumowski, W. Note sur deux écrits médicaux de MATHIAS DE MIECHOW. Communication faite au Vme Congrès International d'histoire de la médecine. 3 p. Geneva, A. KUNDIG, 1926. ISIS

A propos of the two following plague treatises by the Polish historian, humanist, and physician, MATTHEW OF MIECHOW (1457-1523); both printed at Cracow in 1508: (1) *Contra saevam pestem regimen accuratissimum*; (2) *Fructuosa doctrina de sanguinis missione deque non nullis aliis probatissimis atque salutaribus remediis adversus horrendam pestilentiae luem*. Brief analysis of both. G. S.

Williams, George A. MICHAEL SERVETUS, physician and heretic. *Annals of Medical History*, 10, 287-92, 1928. ISIS

E. — *Alia*.

Ehrenberg, Richard. Capital and finance in the age of the Renaissance. A study of the FUGGERS and their connections. Translated from the German by H. M. LUCAS. 390 p. London, JONATHAN CAPE, 1928. ISIS

Hassler, Friedrich. Augsburger Kauffleute und Tiroler Bergarbeiter im 16. Jahrhundert in England. *Beiträge zur Geschichte der Technik und Industrie*, 17, 80-88, 5 fig. 1927. ISIS

Herborn, Nicolaus. *Locorum communium adversus huius temporis heareses enchiridion* (1529). Hrsg. v. P. PATRICIUS SCHLAGER. (Corpus Catholicorum, H. 12). XXVIII + 192 p. Münster, ASCHENDORFF, 1927. ISIS

Reviewed by ANDREAS BIGELMAIR, *Deutsche Literaturzeitung*, 5, 1798-1800, 1928.

Stapleton, Thomas (1535-98). The life and illustrious martyrdom of Sir THOMAS MORE. Translated, for the first time, into English by PHILIP E. HALLETT. London, BURNS OATES, 1928. ISIS

The Latin text was published at Douay in 1588.

XVth Century (second half).

A. — Mathematics.

Ginsburg, Jekuthiel. On the early history of the decimal point. *The American Mathematical Monthly*, 35, 347-349, facs., 1928. ISIS

« The purpose of this article is to call attention to a fact which seems to have been overlooked by all historians, namely, that the credit of being the first to use a dot (point) as a separatix, with a full knowledge of its significance in this connection, is due to the Jesuit father CHRISTOPHER CLAVIUS (1537-1612). In his work on the astrolabe, published in Rome in 1593 he gives (pp. 195-270) a 'Tabula Sinuum,' where the proportional parts are separated from the integers by periods (points, dots). »

Vetter, Quido. *Arithmetica de JIRIK GOERL z Goerlsteyna*. 2 p. dated Prague April 1928, apparently reprinted from *Schola et vita*, organo de academia pro interlingua. ISIS

JIRIK (i.e. GEORGE) GOERL (or GEHR, GERL) was born in Elnbogen, northern Bohemia; in 1566-67 he was teaching in Litomerice, later he was « arithmeticus » in Prague. He published a German arithmetic « Ein nutzlich und künstlich Rechenbuch », in Prague, 1577 (preface dated 1576.12.24) and soon afterwards an enlarged edition in Bohemian (preface dated 1577.08.07). G. S.

C. — Natural Sciences.

Bushnell, Jr., David I. Drawing by JACQUES LEMOYNE DE MORGUES of SATURIOUA, a Timucua chief in Florida, 1564. *Smithsonian miscellaneous collections*, vol. 81, no. 4, 9 p., 1 fig., 1 pl. Washington, Smithsonian Institution, 1928. ISIS

« Not until the year 1564, when the French expedition led by LAUDONNIÈRE set sail from Havre de Grace for the Land of Florida, did an artist accompany an expedition for the definite purpose of making drawings to be taken back to Europe. Consequently JACQUES LEMOYNE DE MORGUES, artist, who accompanied LAUDONNIÈRE, made the earliest known pictures of Indians of North America. Many sketches were undoubtedly made by the artist during the eventful year he remained in Florida but only one original example of his work can now be traced, this being a drawing of the great chief SATURIOUA who claimed the land on which the French erected Fort Carolina ».

Wagner, Henry R. Sir FRANCIS DRAKE's voyage around the world,

its aims and achievements. x + 543 p. San Francisco, HOWELL, 1926. ISIS

Reviewed by ZELIA NUTTALL, *American Historical Review*, 34, 114-17, 1928.

D. — *Medical Sciences.*

Nuyens, B. W. Th. Een vliegend blaadje uit de 16de eeuw, als reclame voor de badplaats Pyrmont. *Bijdragen tot de geschiedenis der geneeskunde* 8, 113-118, 1928. ISIS

Pas, J. de ; Lanselle, M. Documents sur la peste de 1596 à Saint-Omer. *Bulletin de la société française d'histoire de la médecine*, 22, 206-16, 1928. ISIS

Price, George E. SHAKESPEARE as a neuropsychiatrist. *Annals of medical history*, 10, 159-64, 1928. ISIS

Sabbatani, Luigi. Acqua vitae LUCAE GHINI. *Arch. di storia d. sc.*, 8, 477-84, 1927. ISIS

La formule de cette *acqua vitae* nous a été conservée par JOHANN JACOB WECKER (Bâle, 1528-Colmar, 1586), dans son *Antidotarium generale* (1574-6), et par GIOVANNI BATTISTA CORTESI (Bologna, 1556-Reggio Calabria, 1636), dans sa *Pharmacopeia, seu Antidotarium Messanense*, 1629. — Composition de cette *acqua vitae*; son action pharmacologique. L. G.

E. — *Alia.*

Camoens, Luis de. Os Lusíadas. Lisbon, Imprensa Nacional, 1928. ISIS

Critical edition prepared by ALONSO LOPES VIEIRA and JOSÉ MARIA RODRIGUES.

Mesnard, Pierre. DU VAIR et le néo-stoïcisme. *R. d'hist. de la philosophie*, 2, 142-66, 1928. ISIS

GUILLAUME DU VAIR (Paris, 1556-Tonneins, 1621), magistrat et philosophe.

XVIIth Century (whole and first half).

A. — *Mathematics.*

Artom, Emilio. Sul concetto di rapporto secondo GALILEO GALILEI. *Bolletino di Matematica*, 50-2, Maggio, 1928. ISIS

Caspar, Max. JOHANNES KEPLER und seine Entdeckung des Flächensatzes. Festschr. z. 30 Hauptvers. der Deutsch. Ver. z. Ford. der math. und nat. Unt. zu Stuttgart, 44-53, Bildnis, 1928. ISIS

Descartes, René. La géométrie. Nouvelle édition, avec portrait de DESCARTES, d'après FRANS HALS. Paris, J. HERMANN, 1927. ISIS

Reproduction d'une édition de la Géométrie, que rien ne permet d'identifier, l'éditeur ayant substitué son nom au nom de l'éditeur dont il reproduit la typographie, et le millésime 1927 à l'année de l'apparition de l'édition reproduite. L. G.

Feldhaus, Franz Maria. Die logarithmischen Rechenstäbe und ihre Nachfolger. 4. Euklid-Feldhaus-Beilage zur Maschinen-Buchhaltung, p. 13-16, illus., 1928. ISIS

Feldhaus, Franz Maria. Eine Rechenschiene von 1609. 5. Euklid-Feldhaus-Beilage zur Maschinen-Buchhaltung, 4 p., August, 1928. ISIS

Kokomoor, F. W. The teaching of elementary geometry in the seventeenth century. Preface by L. C. KARPINSKI. *Isis*, 10, 21-32, 1928 ISIS

Kokomoor, F. W. The distinctive features of the seventeenth century geometry. *Isis*, 10, 367-415, 1928. ISIS

(Pascal, Blaise). « Essay pour les coniques ». Translated by FRANCES MARGUERITE CLARKE. Preface by DAVID EUGENE SMITH. *Isis*, 10, 16-20, double pl., 1928. ISIS

Wieleitner, H. Zur Geschichte der Polargleichung der Ellipse. *Unterrichtsblätter für Mathematik und Naturwissenschaften*, 34, 276-7, 1928. ISIS

Explaining KEPLER's discovery of it in modern language. G. S.

B. — *Physical Sciences and Technology.*

Jungius, Joachim (Lübeck 1587 — Hamburg, 1657). Zwei Disputationen über die Prinzipien (Teile) der Naturkörper. 35 p. Hamburg, Gutenberg Verlag, 1928. ISIS

The two disputations *De principiis corporum naturalium* here translated are both dated Hamburg, 1642. This handsome booklet was distributed to the members of the ninetieth meeting of the Deutsche Naturforscher und Ärzte (Hamburg, 1928), a very appropriate gift, which I hope will help to draw the attention of the learned world upon a great but neglected personality. I quote from ADOLF MEYER's excellent introduction :

« JOACHIM JUNGIIUS hat in der Geschichte der Naturwissenschaften und der Logik tatsächlich die Rolle gespielt, die die Nachwelt in der Regel, aber zu Unrecht dem Engländer FRANCIS BACON zugewiesen hat. Die wesentliche Leistung der 'neuen Wissenschaft', die GALILEI, HARVEY und DESCARTES der Menschheit gebracht haben, besteht nicht darin, auf induktive Weise Erfahrungen zu sammeln und Experimente anzustellen — beides hat man

in der Antike, besonders im Athen des ARISTOTELES, in Alexandrien und im Rom GALENS bereits ausgezeichnet verstanden, — sondern lediglich in dem Bestreben, die Naturerscheinungen mathematisch zu bewältigen und so die Naturwissenschaften zu mathematisieren. In diesem Sinne formulierte GALILEI als das Leitmotiv seiner 'ganz neuen Wissenschaft von uralten Dingen' die Forderung, 'zu messen, was man messen kann, und messbar zu machen, was man noch nicht messen kann'. BACON hat von diesem neuen Geiste nur wenig gespürt. Nicht nur sind seine 'Tabulae' der Induktion geradezu erstaunlich hilflose Gebilde, er selbst hat auch jene grossen Forscher, die wie KEPLER, KOPERNIKUS und GALILEI das Neue zu seiner Zeit bereits verwirklichten, nicht nur nicht verstanden, sondern sogar bekämpft. Ganz anders JUNGIIUS. Er hat einmal durch klare Erkenntnis der Bedeutung der Mathematik für die neue Naturerkenntnis — seine Giessener Antrittsvorlesung, die er im Alter von 20 Jahren hielt, als gerade GALILEIS erste Werke erschienen waren, führt schon den Titel: *De matheseos dignitate, praestantia et usu* — begriffen, wohin die neue Reise des forschenden Geistes gehen würde, er hat weiterhin der werdenden Naturerkenntnis, insbesondere der neuen Physik, in seiner *Logica Hamburgensis* auch die ständig an LEIBNIZ, der JUNGIIUS stets sehr bewundert hat, und KANT gemahnende erkenntnistheoretische Grundlage gegeben.

«Darüber hinaus hat er durch sein der gleichen mathematisierenden Tendenz entsprungenes Bestreben, die Atomistik DEMOKRITS, die einzige antike Lehre, die der modernen Naturwissenschaft geistesverwandt ist, zu erneuern, auch positiv in die Gestaltung der modernen Physik eingegriffen. Seiner logischen Ader entsprechend gibt er in den hier vorliegenden beiden Disputationen, deren Bedeutung für das Lebenswerk von JUNGIIUS zuerst WOHLWILL, der hervorragende GALILEI- und JUNGIIUSforscher, sichergestellt hat, so etwas wie eine Axiomatik der Atomistik. Wir finden hier nicht nur alle späteren von DALTON und BOYLE entwickelten Theorien klar entwickelt, manche Sätze gemahnen direkt an Modernstes, z. B. enthalten schon die ersten Paragraphen Bestimmungen, wie sie die moderne Gestalttheorie nicht präziser hat formulieren können.

«In unsern Tagen, in denen gerade die physikalische Atomistik nie geahnte Triumphe feiert, lohnt es sich daher wohl, die Blicke auf einen ihrer theoretischen Begründer und scharfsinnigsten Logiker zurückzulenken. Die hier vorliegenden Übersetzungen hatte WOHLWILL seiner Abhandlung: JOACHIM JUNGIIUS und die Erneuerung atomistischer Lehren im 17. Jahrhundert (in: *Abh. a. d. Gebiete der Naturwiss.*, Bd. 10) Hamburg 1887 auf den Seiten 31 bis 43 eingefügt. Hier erscheinen sie zum ersten Male als eine Art 'Klassiker der exakten Wissenschaften' für sich.» G. S.

Olschki, Leonardo. Geschichte der neusprachlichen wissenschaftlichen Literatur. III. Band: GALILEI und seine Zeit. VIII + 479 S. Halle (Saale), MAX NIEMEYER Verlag, 1927. ISIS
Reviewed by H. WIELEITNER, *Isis*, 10, 499-501, 1928.

Strauss, Heinz Artur und Strauss-Klöbe, Sigrid. Die Astrologie des JOHANNES KEPLER. Eine Auswahl aus seinen Schriften. 226 S. München, OLDENBOURG, 1926. ISIS

Reviewed by MAX CASPAR, *Deutsche Literaturzeitung*, 5, 1573-76, 1928.

Theobald, Dr. Ein venezianisches Patent GALILEO GALILEIS. *Beiträge zur Geschichte der Technik und Industrie*, 17, 24-29, 2 fig., 1927. ISIS

C. — *Natural Sciences.*

Harcourt, Robert (1574?-1631). A relation of a voyage to Guiana. Edited by Sir C. ALEXANDER HARRIS. London, Quaritch for the Hakluyt Society, 1928. ISIS

D. — *Medical Sciences.*

Cohen, Hk. De apotheek van een Rotterdamsch geneesheer in 1603. *Bijdragen tot de geschiedenis der geneeskunde*, 8, 179-184, 1928. ISIS

Feyfer, F. M. G. de. WILLIAM HARVEY (1578-1657). *Bijdragen tot de geschiedenis der geneeskunde*, 8, 119-43, 7 fig., 1928. ISIS

Goulard, Roger. Deux contrats d'apprentissage de compagnon-chirurgien. (1628, 1660). *Bulletin de la société française d'histoire de la médecine*, 22, 219-220, 1928. ISIS

Harvey, William. Exercitatio anatomica de motu cordis et sanguinis in animalibus. Facsimile of first edition, Frankfurt, 1628. Florence, R. LIER, 1928. ISIS

Harvey, William. Anatomical exercises. The first English text of 1653, newly edited by GEOFFREY KEYNES. London, the Nonesuch Press, 1928. ISIS

(Harvey, Wm.) The Harvey tercentenary. *Nature*, 121, 834-35, 1928. ISIS

Keynes, Geoffrey. A bibliography of the writings of WILLIAM HARVEY, M. D., discoverer of the circulation of the blood. (Edition limited to 300 copies.) XII + 68 p., 8 pl. Cambridge, University Press, 1928. ISIS

Scolten, Adrian. NICHOLAS TULP (1593-1674). *Medical life*, 35, 381-91, 1928. ISIS

Wallach, Emil. DESCARTES und HARVEY. *Archiv für Geschichte der Medizin*, 20, 301-6, 1928. ISIS

Wiberg, Julius. WILLIAM HARVEY. 1578-1657. *Ugeskrift for Lager*, 1928; No. 20. ISIS

E. — *Alia*.

Browne, Sir Thomas. Christian morals. The second edition, with the life of the author by SAMUEL JOHNSON. Edited, with an introduction and notes, by S. C. ROBERTS. Cambridge University Press, 1928. ISIS

Browne, Sir Thomas. The complete works of Sir THOMAS BROWNE. Newly edited in six volumes by GEOFFREY KEYNES. Vol. 1. : Religio Medici, Christian Morals, A letter to a friend. London, FABER and Gwyer, 1928. ISIS

Forgue, E. THÉOPHRASTE RENAUDOT, créateur du journalisme en France. 32 p., 8 pl. h. t., MASSON, Paris, 1927. ISIS

Le n° 1 de la *Gazette* parut à Paris le 30 mai 1631. Indications précises sur la composition du journal, et données biographiques sur THÉOPHRASTE RENAUDOT (Loudun, 1586; Paris, 1653), qui joignait à son journal un bureau d'annonces d'emplois disponibles, un bureau de prêts sur gages, et un service de consultations médicales gratuites. L. G.

Gentile, Federico. PASCAL. Saggio d'interpretazione storico. 346 p., G. LATERZA and figli, Bari, 1927. ISIS

Plus qu'un essai d'interprétation historique, l'étude de F. GENTILE me semble être un essai d'interprétation psychologique vue à travers l'histoire, dans lequel l'auteur, regardant PASCAL à la lumière de MONTAIGNE, de DESCARTES, de MÉRÉ, le PASCAL savant et le PASCAL des Provinciales, des Pensées, montre un PASCAL se libérant peu à peu et devenant avant tout religieux, s'imprégnant de jansénisme, se plongeant dans le mysticisme. L. G.

Lloyd, James Hendrie. Sir THOMAS BROWNE and the witches. *Annals of medical history*, 10, 133-7, 1928. ISIS

XVIIIth Century (second half).

A. — *Mathematics*.

Cajori, Florian. Sir ISAAC NEWTON on gravitation. *The Scientific Monthly*, 27, 47-53, 1928. ISIS

Rosenfeld, L. RENÉ-FRANÇOIS DE SLUSE et le problème des tangentes. *Isis*, 10, 416-34, 5 fig., 1928. ISIS

B. — *Physical Sciences and Technology*.

Bloch, Léon. Les théories newtoniennes et la physique moderne. *Rev. de métaphysique et de morale*, 35, 41-54, 1928. ISIS

Comment aux théories newtoniennes se rattachent la théorie d'EINSTEIN, et les conceptions de la mécanique ondulatoire de LOUIS DE BROGLIE.
L. G.

Meldrum, Andrew Norman. The development of the atomic theory : (3) NEWTON's theory, and its influence in the eighteenth century. *Manchester Memoirs*, 55 (1910), No. 4, 15 p., 1910. ISIS

Rugani, Luigi. PIERO MARIA GABRIELI (1643-1705). *Riv. di storia d. sc. med. e natur.*, 18, 183-91, 1927. ISIS
Physicien, philosophe, mathématicien, botaniste, médecin, fondateur en 1691, de l'Académie physiocratique de Sienne. L. G.

C. — Natural Sciences.

Fosi, Vittoria. Identificazione dei « Lumaconi ignudi » di FRANCESCO REDI. *Rassegna di Studi Sessuali*, 8, 19-22, 4 fig., 1928. ISIS

Ovington, John (d. 1731). An essay upon the nature and qualities of tea (1699). Reproduced by permission of the owner of the original document, Mr. ARTHUR WILLIAMS. Preface by AUGUSTINE BIRRELL. XII + 39 p. London, Institute of Certificated Grocers, 1928. ISIS

Packard, Francis R. MARCELLO MALPIGHI. *Annals of medical history*, 10, 209-10, 1928. ISIS

Rostafinski, Josephus. Catalogi plantarum quae a. 1651 Varsaviae in hortis botanicis regis IOANNIS CASIMIRI colebantur, secundum conspectus hortulanorum BARTHOLOMEI GEI et IACOBI HAIC. Accedit catalogus tertius plantarum indigenarum quae circa Varsoviarum nascuntur, auctore MARTINO BERNHARDO. Edidit et ambo priores in systema naturale redegit. (Editionum Collegii ad Historiam scientiarum mathem.-naturalium perscrutandam.. vol. 2) 100 p. Cracoviae, Sumptibus Academiae litterarum et scientiarum Polonae apud bibliopolam G. GEBETHNER et WOLFF, 1928. ISIS

D. — Medical Sciences.

Goulard, Roger. Dans l'intimité d'un maître-chirurgien briard du XVIIe siècle. *Bulletin de la société française d'histoire de la médecine*, 22, 173-8, 1928. ISIS

Apropos of CLAUDE TERRIER, appointed chirurgien-juré at Brie, 1674, died in 1679 at the age of 60.

Hollingsworth, Merrill W. Blood transfusion by RICHARD LOWER

in 1665. Translated from the Latin. *Annals of Medical History*, 10, 213-25, 3 fig., 1928. ISIS

Keussen, Herm. Die Antwort der Kölner Medizinischen Fakultät (1675) an die Erfurter Fakultät in Sachen des Sylvianismus. *Historisches Jahrbuch*, 27, 537-40, München, 1927. ISIS

Larsell, O. OLOF RUDBECK the Elder (1630-1702). *Annals of Medical History*, 10, 301-13, 6 fig., 1928. ISIS

Lint, J. de. Comment JEAN DE DOOT, forgeron, s'opéra d'un calcul de la vessie. *Aesculape*, mars, 50-3, illustr., 1928. ISIS

Pitfield, Robert L. A short account of PEPYS' oculist, D'URBERVILLE, and his family. *Annals of medical history*, 10, 173-9, 1928. ISIS

Schilfgaarde, A. P. van. Een ziektegeschiedenis uit 1656. *Bijdragen tot de geschiedenis der geneeskunde*, 8, 172-8, portr., 1928. ISIS

E. — *Alia*.

Broadhurst, Jean. Peeps with PEPYS at hygiene and medicine. *Annals of medical history*, 10, 165-72, 1 fig., 1928. ISIS

(Petty, Sir William. 1623-1687). The PETTY papers; some unpublished writings of Sir WILLIAM PETTY. Edited from the Bowood papers by the MARQUIS OF LANSDOWNE. Two vols. London, CONSTABLE, 1927. ISIS

Sarton, George. SPINOZA. *Isis*, 10, 11-15, 4 pl., 1928. ISIS

Spinoza. The correspondence of SPINOZA. Translated and edited, with introduction and annotations by A. WOLF. 502 p. London, ALLEN and UNWIN, 1928. ISIS

Tréw, Abdias (1597-1669). Grundriss der verbesserten Astrologie (Reform-astrologie). Ins Hochdeutsche übertragen von JOS. FUCHS. 190 S., 1 Abb. München, HUBER, 1927. ISIS

XVIIIth Century (whole and first half).

A. — *Mathematics*.

Du Pasquier, L. Gustave. LÉONARD EULER et ses amis. IX + 125 p. Paris, J. HERMANN, 1927. ISIS

Reviewed by T. L. HEATH, *Nature*, 121, 786-87, 1928.

B. — *Physical Sciences and Technology.*

Birk, Alfred. Die technische Verwaltung der österreichischen Reichsstrassen im 18. Jahrhundert. *Beiträge zur Geschichte der Technik und Industrie*, 2, 75-88, 1921. ISIS

Davis, Tenney L. The vicissitudes of BOERHAAVE's textbook of chemistry. *Isis*, 10, 33-46, 2 pl., 1928. ISIS

Davis, Tenney L. BOERHAAVE's account of PARACELSUS and VAN HELMONT. *Journal of Chemical Education*, 5, 671-681, 1928. ISIS

« The history of chemistry which stands at the beginning of BOERHAAVE's treatise on that science is perhaps the oldest history of chemistry (of chemistry as distinct from alchemy) which we have. BOERHAAVE was born but a few years after the appearance of « The Sceptical Chymist. » He was contemporary with STAHL but had no sympathy with the doctrine of phlogiston. He lived at a time when chemistry had recently become a well-recognized science in its own right. He actually talked with those who had talked with VAN HELMONT, and VAN HELMONT, who was born thirty-six years after the death of PARACELSUS, thought so highly of the founder of chemical medicine that he visited his haunts to learn all that he could about him. When BOERHAAVE tells us about these two men, one of the greatest physicians and chemists of all time is telling us about his two most eminent predecessors. »

Gardenghi, Giuseppe. Nel secondo centenario della scoperta del glutine (G. B. BECCARI, 1728). *Riv. di storia d. sc. med. e nat.*, 19, 36-42, 1928. ISIS

La découverte du gluten est due (1728) à GIACOMO BARTOLOMEO BECCARI (Bologna, 1682, 07, 25 — id., 1766, 01, 30). L. G.

Hennig, Richard. Aus der Geschichte des Blitzableiters. Zur Priorität der Franklinschen Erfindung des Blitzableiters. *Beiträge zur Geschichte der Technik und Industrie*, 16, 183-199, 1926. ISIS

« Die Verknüpfung der beiden Erfahrungen, dass Elektrizität in Metallen am liebsten ihren Weg sucht und dass Blitz und Donner offenbar als Entladung eines elektrischen Funkens angesprochen werden müssten, hat dann BENJAMIN FRANKLIN unzweifelhaft als Erster durchdacht, und sie führte ihn schliesslich zu dem gewaltigen, erfinderischen Gedanken, der in seinem eingangs erwähnten Brief an PETER COLLINSON vom 29. Juli 1750 niedergelegt ist. *Die Erfindung des ersten Blitzableiters kann FRANKLIN unter keinen Umständen abgesprochen werden.* Mit vollem Recht steht auf seinem Grabstein : *Eripuit coelo fulmen.* »

Triewald, Marten (1691-1747). Short description of the atmospheric engine. Published at Stockholm, 1734. Translated from the Swedish with foreword, introduction and notes. XII + 61 p., 1 pl., facs. Newcomen Society, Extra publication no. 1, London, 1928. ISIS

« The name of MARTEN TRIEWALD is known to all those who have studied the history of the steam engine, but very few have any acquaintance with his book on the subject. In the first place it is extremely rare, and, next, it is written in Swedish, a language that is not widely spread among students of the history of engineering. There are earlier descriptions of the NEWCOMEN engine, as by LEUPOLD, SWITZER, and WEIDLER, but TRIEWALD's book is the first publication devoted solely to the engine, and the author knew NEWCOMEN and his partner CAWLEY, or CALLEY, personally; he had a practical knowledge of the engine and had put up more than one in this country. »

C. — *Natural Sciences.*

Gertz, Otto. LINNÉ i Lund, Föredrag i Kungl. Fysiografiska Sällskapet den 2 Dec. 1927. 22 p., Lund, 1928. ISIS

LINNÉ, the famous botanist, came to Lund on August 17, 1727, and obtained his first academic education at the university there. He stayed there only a year and went then to Upsala, where he finished his studies and where he took up the work which made him famous all over the world.

J. W. S. J.

E. — *Alia.*

Lenoir, Raymond. Les historiens de l'esprit humain. VII + 173 p., Paris, ALCAN, 1926. (12 fr.) ISIS

Reviewed by HÉLÈNE METZGER, *Isis*, 10, 501-2, 1928.

XVIIIth Century (second half).

B. — *Physical Sciences and Technology.*

Goethe, J. W. v. Beiträge zur Optik. Erstes Stück, 62 S., 27 Taf. Zweites Stück, 31 S., Taf. und Kupfer. Faksimilierte Ausgabe mit einem Nachwort (21 S.) von JULIUS SCHUSTER. Weimar, im Verlag des Industrie-Comptoirs, 1791 (bzw. 1792). Berlin, JUNK, 1928. ISIS

Goethe, J. W. v. Farbenlehre. 686 p., 31 colored pl. Leipzig, Insel-Verlag, 1928. ISIS

Leroux, Lucien et Désiré. LAVOISIER. (Nobles vies, grandes œuvres, 12). 125 p. Paris, PLON, 1928. ISIS

Lippmann, Edmund O. von. CAZAUD über den Anbau des Zuckerrohres (1781) (Aus der in Vorbereitung begriffenen Neuauflage der « Geschichte des Zuckers ».) Berlin, *Die Deutsche Zuckerindustrie*, Nr. 23, S. 629, Jahrg. 1928. ISIS

Meldrum, Andrew Norman. Two great Irish chemists. BRYAN HIGGINS (1737-1820) and WILLIAM HIGGINS (d. 1825). *The New Ireland Review*, p. 275, 350, 1909 (?). ISIS

Meldrum, Andrew Norman. The development of the atomic theory. (1) BERTHOLLET's doctrine of variable proportions. *Memoirs of the Manchester Philosophical Society*, vol. 54, no. 7, 1910. ISIS

Mieli, Aldo. ALESSANDRO VOLTA. Zur Gedenkfeier an seinen 100 jährigen Todestag. *Beiträge zur Geschichte der Technik und Industrie*, 17, 51-54, portr., 1927. ISIS

E. — *Alia.*

Newell, Lyman C. Count RUMFORD, scientist and philanthropist. *Science*, 68, 67-73, July 27, 1928. ISIS

Partington, J. R. The composition of water. (Classics of scientific method.) VIII + 106 p. London, BELL, 1928. ISIS
Reviewed in *Nature*, 121, 981, 1928.

Roe, Joseph W. ELI WHITNEY, 1765-1825. Der Erfinder der Baumwollentkernmaschine und der Schöpfer der austauschbaren Fertigung. *Beiträge zur Geschichte der Technik und Industrie*, 10, 155-174, 10 fig., 1920. ISIS

Schiffner, C. WILHELM AUGUST LAMPADIUS (1772-1842). *Beiträge zur Geschichte der Technik und Industrie*, 12, 40-50, 4 fig., 1922. ISIS

Schwemann, A. FRIEDRICH ANTON Frh. v. HEINITZ (1725-1802). Preussischer Bergwerksminister. Ein Lebensbild. *Beiträge zur Geschichte der Technik und Industrie*, 12, 159-172, portr., 1922. ISIS

C. — *Natural Sciences.*

Blaser, Julius. Gebirgsreisen in der Schweiz gegen Ende des 18. Jahrhunderts. Eine kulturgeschichtliche Skizze. *Die Alpen*, Monatsbericht des schweizer Alpenclub, 174-186; 201-13, 8 pl., Bern, 1926. ISIS

Brunet, P. GUÉNEAU DE MONTBÉLIARD (1720-1785). *Mém. de l'Acad. des sc., arts et belles-lettres de Dijon*, 125-31, 1925. ISIS

Coutinho, Gago. Travessia da Africa pelo Dr. LACERDA E ALMEIDA.

Boletim da agencia geral das colónias, Ano 3, no. 22, p. 59-83, Abril, 1927.

ISIS

Conclusion of the series for which see *Isis*, 10, 181.

J. K. W.

Gidon, F. Deux thèses de Caen sur la méthode de BERNARD DE JUSSIEU (1747 et 1778). *Bulletin de la société française d'histoire de la médecine*, 22, 179-184, 1928.

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Hermannsson, Halldór. Sir JOSEPH BANKS and Iceland. (*Islandica*: vol. 18). x + 99 p., 27 pl. Ithaca, N. Y., Cornell University Library, 1928.

ISIS

Jenkins, Pierre Gautier. ALEXANDER GARDEN, M. D., F. R. S. (1728-1791), colonial physician and naturalist. *Annals of Medical History*, 10, 149-158, 1928.

ISIS

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HOFMANN speculated about the density of atoms and about the spaces between them, etc. He held that the purely mechanical theory of heat as then recently developed by MAYER, JOULE, THOMSON, and HELMHOLTZ is inade-

quate to account for the phenomena of physics and chemistry — and that the particular properties of the kind of matter which is involved must be taken into the reckoning. He was apparently the first to see the necessity for a special science — Somatology — which should develop from the same causes the phenomena of chemistry, of crystallography, and of physics. To that extent he laid the early foundations for the work of VAN DER WAALS, RICHARDS, BRAGGE, and BOHR.

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Reviewed in *Nature*, 122, 124-25, 1928.

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Borisiak, A. V. O. KOVALESKII, his life and works. Publications on the history of science, no. 5, 135 p., illustrated (in Russian) Academy of Sciences, Leningrad, 1928. ISIS

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Reviewed by YOSHIO MIKAMI, *Isis*, 10, 80, 1928.

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Thomsen, Oluf. BERNHARD BANG, 80 aar. *Politiken*, June 1928. ISIS

BANG was born on the 7-6, 1848. Dr. med., 1880. He took up the study of veterinary science in 1880, became Prof. in 1892. Director of the veterinary

high-school at Copenhagen 1900-01, then veterinary superintendent (physicus) for Denmark. Renowned for his studies in tuberculosis and in the infectious abortion of cows. His bust was unveiled in the garden of the high-school on Nov. 23. J. W. S. J.

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E. — *Alia.*

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Andler, Charles. NIETZSCHE et ses dernières études sur l'histoire de la civilisation. *R. de métaphys. et de morale*, 35, 161-91, 1928. ISIS

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XXth Century

A. — Mathematics.

Peeters, P. (S. J.) Le R. P. HENRI BOSMANS (S. J.). *Rev. des Quest. scientif.*, 13, 201-14, 1928. ISIS

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Srikantia, B. M. SRINIVASA RAMANUJAN (1887-1920). *The American mathematical monthly*, 35, 241-245, 1928. ISIS

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D'après les travaux de C.V.L. CHARLIER, directeur de l'observatoire de l'université de Lund, et ses collaborateurs : W. GYLLENBERG, G. MALMQUIST. S. D. WICKSELL.

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Bateson, Beatrice. WILLIAM BATESON, F. R. S., Naturalist : his essays and addresses; together with a short account of his life. ix + 473 p., 4 pl. Cambridge, University Press, 1928. ISIS
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RENÉ QUINTON, 1866-1925. Critique d'art. Biologiste : *L'eau de mer, milieu organique*, MASSON, Paris, 1904. C'est de la théorie de QUINTON que dérive, d'abord appliquée par lui-même, puis très largement répandue, la thérapeutique par l'eau de mer en injections sous-cutanées. Un des pionniers de l'aviation, bien qu'il ne fut pas lui-même aviateur.

L. G.

E. — *Alia.*

Bousquet, G. H. VILFREDO PARETO, sa vie et son œuvre. 230 p., 4 fig., facsimile. Paris, PAYOT, 1928.

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Burlond, Albert. La pensée d'après les recherches expérimentales de H. J. WATT, de MESSER et de BÜHLER. 192 p. Biblioth. de philos. contempor., F. ALCAN, Paris, 1927.

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Les recherches de ces trois savants se sont poursuivies, avec le concours de O. KÜLPE de 1902 à 1908 à Würzburg; elles ont été publiées dans les *Archiv für die gesamte Psychologie*, et ont suscité de nombreux travaux. « WATT a examiné le plus simple des phénomènes de l'idéation, l'évocation dirigée ou l'association logique; chez (A.) MESSER, c'est le jugement qui vient au premier plan, et chez (C.) BÜHLER l'intellection, c'est à dire l'un des problèmes les plus compliqués de la pensée. »

L. G.

PART II.

HISTORICAL CLASSIFICATION.

Including only the items which could not be included in Part I — the fundamental (centurial) classification. Hence a student of Muslim science, for example, should not peruse simply the notes collected below under the heading « Islam », he should examine as well those included above under the headings VIIth century, VIIIth century, etc.

CONTENTS :

- I. — *Antiquity* : 1. Antiquity (generalities); 2. Egypt; 3. Babylonia and Assyria; 4. Greece; 5. Rome.
- II. — *Middle Ages* : 6. Middle Ages (generalities); 7. Byzantium.
- III. — *Oriental Science and Civilization* : 8. Asia (generalities; Western Asia; Central Asia; Eastern Asia); 9. India; 10. China; 11. Japan; 12. Israel; 13. Iran; 14. Islam.

I. — ANTIQUITY

I. — ANTIQUITY (*generalities*).

Englert, Ludwig. Die gegenwärtige Situation der Forschung zur Geschichte der antiken Medizin. *Archiv für Geschichte der Medizin*, 20, 307-26, 1928. ISIS

Evans, Sir Arthur John. The palace of MINOS at Knossos. A comparative account of the successive stages of the early Cretan civilization as illustrated by the discoveries at Knossos. Vol II. In two parts. 844 p., 31 pl. London, MACMILLAN, 1928. ISIS

Halliday, William Reginald. Greek and Roman folklore. (Our debt to Greece and Rome series). XI + 154 p. London, GEORGE G. HARRAP, 1927. ISIS

Kamal, Prince Youssouf. Monumenta cartographica Africae et Aegypti, vol. 1, 107 p., portr. and 64 plates of maps printed in heliogravure. Cairo, 1926. (Private publication, no publisher named). ISIS

Only 100 copies of this sumptuous and very bulky publication (which measures 62 × 75 cm.!) were printed and none of them placed on sale. A high quality of paper was used; all the principal names in the letterpress appear in red. As a work of art the volume has no little value, but as a work of scholarship its utility is questionable. The author has reproduced a sequence of maps of Egypt, Africa, and of the oikoumene: modern scholars' hypothetical reconstructions of the maps of ancient geographers, historians, and poets of the epoch before PTOLEMY. We thus have: HOMER's conception of the known world as interpreted by J. H. VOSS in 1802; HERODOTUS' view of Egypt as interpreted by A. J. BOON in 1843; the geographical system of HIPPARCHUS as interpreted by F. J. GOSSELIN in 1803; ARTEMIDORUS' world map as interpreted by KONRAD MILLER in 1898; etc. To illustrate SALLUST's conception of geography the medieval «Sallust» maps are used. The works of modern scholarship which Prince YOUSSEUF KAMAL has so carefully reproduced for the most part date from the eighteenth and early nineteenth centuries. No critical student can accept these reconstruction of ancient maps as final. The letterpress consists of brief estimates of the significance of the various ancient writers in relation to the history of geography; excerpts with French translation are given from the texts, especially in so far as they relate to Africa. J. K. W.

Köhlm, Josef. Zur Auffassung und Darstellung des Wahnsinns im klassischen Altertum. (Beilage zum Jahresber. der Hess. Gymnas. in Mainz 1927-28.) 32 p. Mainz, L. WILCKENS, 1928. ISIS

Kubitschek, Wilhelm. Grundriss der antiken Zeitrechnung. (*Handbuch d. Altertumswiss.* begr. von IWAN VON MÜLLER, neu hrsg. von

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Reviewed by R. LAQUEUR, *Deutsche Literaturzeitung*, 1122-1124, 1928, and by S. DE RICCI, *Journal des savants*, 293, 1928.

Nilsson, Martin P. The Minoan-Mycenaean religion and its survival in Greek religion. XXIII + 581 p., 4 pl. Lund, GLEERUP, 1928. ISIS

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Reviewed by FRANZ CUMONT, *Journal des savants*, 305-14, 1928.

2. — EGYPT.

Almagià, Roberto. L'opera degli Italiani per la conoscenza dell'Egitto e per il suo risorgimento civile ed economico. Scritti di vari autori raccolti e coordinati. Parte prima. XI + 200 p. Roma, Provveditoriato Generale dello Stato-Libreria, 1926. ISIS

Reviewed in 36^e *Bibliographie géographique*, p. 481.

Chaîne, Marius. La chronologie des temps chrétiens de l'Egypte et de l'Ethiopie. Historique et exposé du calendrier et du comput de l'Egypte et de l'Ethiopie depuis les débuts de l'ère chrétienne à nos jours, accompagnés de tables donnant pour chaque année, avec les caractéristiques astronomiques du comput alexandrin, les années correspondantes des principales ères orientales, suivis d'une concordance des années juliennes, grégoriennes, coptes et éthiopiennes avec les années musulmanes, et de plusieurs appendices. XV + 344 p. Paris, GEUTHNER, 1925. ISIS

Reviewed by J. B. CHABOT, *Journal des Savants*, 373, 1928.

Chronique d'Egypte. Bulletin périodique de la fondation égyptologique Reine Elisabeth. No 1, Décembre 1925; etc.; no 5, Décembre 1927. Bruxelles, Musées Royaux du Cinquanteenaire. ISIS

Quoique cette *Chronique* n'ait aucune prétention scientifique, elle contient des informations abondantes sur les fouilles et autres travaux en progrès, et une bibliographie égyptologique et papyrologique qui paraît fort complète. Elle est envoyée gratuitement aux membres de la Fondation et n'est pas mise dans le commerce. G.S.

Davies, Norman de Garis. Two Ramesside tombs at Thebes. With plates in colour by N. DE GARIS DAVIES, H. R. HOPGOOD, C. K. WILKINSON, the late NORMAN HARDY, and NINA DE GARIS DAVIES. New York, Metropolitan Museum of Art, 1927. ISIS

- Gardiner, Alan H.** Catalogue des caractères d'impression hiéroglyphiques égyptiens d'après les matrices appartenant à ALAN H. GARDINER. En deux dimensions 18 points et 12 points avec grandeurs intermédiaires. 45 p. Bruxelles, Edition de la Fondation Egyptologique Reine Elisabeth, 1928. ISIS
- Griffith, F. Llewellyn.** The teaching of AMENOPHIS, the son of Kankht. Papyrus B. M. 10474. *Journal of Egyptian archaeology*, 12, 191-231, 1926. ISIS
- Hurry, Jamieson B.** IMHOTEP, the vizier and physician of King ZOSER, and afterwards the Egyptian god of medicine. Second edition, revised. London, Oxford University Press, 1928. ISIS
First edition 1926; *Isis*, 11, 215.
- Junker, Hermann.** Die Stele des Hofarztes IRJ. *Zeitschr. f. ägypt. Sprache und Altertumskunde*, 63, 53-70, 1927. ISIS
Reviewed by M. MEYERHOF, *Mitteilungen zur Geschichte der Medizin und der Naturwissenschaften*, 27, 336, 1928.
- Keimer, Ludwig.** The wisdom of AMEN-EM-OPE and the Proverbs of SOLOMON. *American Journal of Semitic Languages and Literatures*, 43, 8-21, October 1926. ISIS
- Lagier, Camille.** Autour de la Pierre de Rosette. 159 p., 11 planches. Bruxelles, Edition de la Fondation Egyptologique Reine Elisabeth, 1927. ISIS
Excellent compte rendu orné de beaux portraits des protagonistes : JEAN FRANÇOIS CHAMPOLLION, SILVESTRE DE SACY, THOMAS YOUNG, EMMANUEL DE ROUGÉ, FRANÇOIS CHABAS, LE PAGE RENOUF. Le manque d'index est déplorable. D'après GIUSEPPE GABRIELI (*Chronique d'Egypte*, n° 5, 105, 1927) il n'est pas exact que I. ROSELLINI et L. M. UNGARELLI aient pillé la grammaire copte et le travail sur les obélisques romains de CHAMPOLLION. G. S.
- Mattirolo, Oreste.** I vegetali scoperti nella tomba dell'architetto KHA e di sua moglie MIRIT nella necropoli di Tebe, dalla Missione archeologica italiana diretta dal Senatore E. SCHIAPARELLI. *Atti della Reale Acad. delle Scienze di Torino*, 61, 545-68, fig., 1926. ISIS
- Mehmke, R. L.** Beitrag zur Geschichte des Wasserbaus im alten Aegypten. *Beiträge zur Geschichte der Technik und Industrie*, 16, 280-89, 10 fig., 1926. ISIS
- Menascha, Ibrahim.** Die Geburtshilfe bei den alten Aegyptern. *Archiv für Gynäkologie*, 131, 425-461, 26 Abb., 1927. ISIS

Meyer, Eduard. Geschichte des Altertums. Band II., Abteilung I., Zweite Auflage, Die Zeit der Aegyptischen Grossmacht. xiv + 620 p. Stuttgart, J. G. COTTA, 1928. ISIS

Reviewed by A. T. OLMSTEAD, *American Historical Review*, 34, 95-97, 1928.

Möller, Georg. Die Metallkunst der alten Aegypter. Mit Literaturzusammenstellung und 48 Tafeln. 68 S. Berlin, ERNST WASMUTH, 1925. ISIS

Newberry, Percy Edward. Aegypten als Feld für anthropologische Forschung. Deutsch herausgegeben von GÜNTHER ROEDER. (*Der Alte Orient*, Bd. 27, H. 1). 38 p. Leipzig, HINRICHS, 1927. ISIS

Rey, Abel. Coup d'œil sur la médecine égyptienne. *Archeion, arch. di storia d. scienza*, 9, 10-29, 1928. ISIS

Après un rappel de ce qu'on pouvait penser de la médecine égyptienne avant l'étude du papyrus d'EDWIN SMITH par JAMES HENRY BREASTED, l'auteur examine le contenu du papyrus, et tire les conclusions qu'impose son ancienneté (*Isis*, 5, 447-9). L. G.

Schweinfurth, Georg. (1836-1925). Bibliographie de ses ouvrages. Extrait du *Bulletin de la Société royale de Géographie d'Egypte*, 14, 73-112, Le Caire, 1926. ISIS

Simpson, David Capell. The Hebrew Book of Proverbs and the Teaching of AMENOPHIS. *Journal of Egyptian Archaeology*, 12, 232-239, 1926. ISIS

Weill, Raymond. Bases, méthodes et résultats de la chronologie égyptienne. 216 p. Paris, GEUTHNER, 1927. ISIS

Reviewed by ETIENNE DRIOTON, *Journal des Savants*, 217-222, 1928.

Weynants-Ronday, Marie. Les statues vivantes. Introduction à l'étude des statues égyptiennes. Préface de JEAN CAPART. xi + 203 p. Bruxelles, Edition de la Fondation Egyptologique Reine Elisabeth, 1926. ISIS

Cette étude dépasse de beaucoup le domaine de l'égyptologie, car l'auteur a tâché d'expliquer la notion de *Ka* et les « statues de double » par une enquête approfondie dont elle a cherché les éléments dans le monde entier. Elle s'est surtout beaucoup servie du *Golden Bough* de FRAZER et du *Religious system of China* de J.J.M. DE GROOT. C'est une contribution importante à l'étude de l'idée d'âme. G. S.

Weynants-Ronday, Marie. Le Livre de Sagesse d'AMENEMOPE. *Chronique d'Egypte*, no. 3, p. 50-56, Bruxelles, octobre 1926. ISIS

Traduction du texte du papyrus 10,474 du British Museum. C'est un texte

de la XXI^e ou de la XXII^e dynastie, et il est probable que c'est bien un ouvrage de cette époque et non pas la transcription en néo-égyptien d'un ouvrage plus ancien. Voir ci-dessus les notes F. L. GRIFFITH, L. KEIMER, et D. C. SIMPSON. G. S.

Wreszinski, Walter. Bericht über die photographische Expedition von Kairo bis Wadi Halfa zwecks Abschluss der Materialsammlung für meinen Atlas zur altägyptischen Kulturgeschichte. (*Schriften der Königsb. Gelehrt. Ges.*, 4. Jahr, H. 2) VIII p. 19-105, 77 pl. Halle, MAX NIEMEYER, 1927. ISIS

3. — BABYLONIA AND ASSYRIA.

Desch, Cecil Henry. Report on the metallurgical examination of specimens for the Sumerian Committee of the British Association for the advancement of science, Glasgow meeting, 4 p. 1928. ISIS

Hall, H. R. Babylonian and Assyrian sculpture in the British Museum. 55 p., 60 pl. Paris, VAN OEST, 1928. ISIS

Meissner, Bruno. Könige Babyloniens und Assyriens. Charakterbilder aus der altorientalischen Geschichte. 314 p. Leipzig, QUELLE und MEYER, 1926. ISIS

Reviewed by B. LANDSBERGER, *Deutsche Literaturzeitung*, 1221-1223, 1928.

Neugebauer, O. Zur Geschichte des Pythagoräischen Lehrsatzes. *Nachr. Ges. Wiss. Gött., math.-phys. Kl.*, 4 p., 1928. ISIS

Smith, Sidney. Early history of Assyria to 1000 B. C. (History of Babylonia and Assyria). XXVII + 418 p., pl., illus. London, CHATTO and WINDUS, 1928. ISIS

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4. — GREECE.

Calhoun, Georges Miller and Delamere, Catherine. A working bibliography of Greek law. With an introduction by ROSCOE POUND. XIX + 144 p. Cambridge, Mass., Harvard University Press, 1927. ISIS

« Most complete for the classical period. Titles arranged alphabetically in a single list. »

Geffcken, Johannes. Griechische Literaturgeschichte. Bd. I : Von den Anfängen bis auf die Sophistenzeit. Mit einem Sonderbd. : Anmerkungen. (*Bibl. der Klass. Altertumswiss.* hrsg. von J. GEFFCKEN.

Bd. 4.) XII + 328 S.; VII + 317 S. Heidelberg, C. WINTER, 1926.

ISIS

Reviewed by ALFRED KÖRTE, *Deutsche Literaturzeitung*, 1354-1357, 1928.

Gomperz, Heinrich. Die Lebensauffassung der griechischen Philosophen und das Ideal der inneren Freiheit. 12 gemeinverst. Vorlesungen. Mit Anhang: Zum Verständnis der Mystiker. Dritte völlig umgearbeitete und erweiterte Auflage. VI + 322 p. Jena, DIEDERICH, 1904.

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Hasebroek, Johannes. Staat und Handel im alten Griechenland. Untersuchungen zur antiken Wirtschaftsgeschichte. VIII + 200 S. Tübingen, J. C. B. MOHR (PAUL SIEBECK), 1928.

ISIS

Reviewed by FRIEDRICH OERTEL, *Deutsche Literaturzeitung*, 5, 1618-1629, 1928.

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ISIS

Diese wertvolle Schrift ist einem seltenen Zusammenwirken mehrerer Hochschullehrer verschiedener Fächer an der Universität Kiel entsprungen (ausser dem Mathematiker und dem Philosophen, die als Verf. zeichnen, noch dem Mathematiker O. TÖPLITZ und dem Altsprachler J. STENZEL). Der dem Titel entsprechende Aufsatz geht bis S. 27. Dann folgt bis S. 34 als Nachtrag eine Auseinandersetzung mit einem früheren Artikel von T. BONNESEN über denselben Gegenstand. Am Schluss kommt ein « Anhang » beträchtlichen Umfangs von H. SCHOLZ (unter Mitwirkung von H. HASSE) « Warum haben die Griechen die Irrationalzahlen nicht aufgebaut? » Der erste Teil stellt in schärfster historischer und logischer Exaktheit den Aufbau der Verhältnislehre des EUDOXOS, bes. im Vergleich mit der Schnitt-Theorie DEDEKINDS dar. Im « Anhang » kommt Verf. zu der Antwort, dass die Griechen durch das starre Identifizieren von « ganzer Zahl » und « Zahl » überhaupt schon nicht zu den « rationalen Zahlen » und daher auch nicht zu den Irrationalzahlen kommen konnten.

H. W.

Herrmann, Aloys. Das Delische Problem. (Die Verdoppelung des Würfels.) (*Mathem.-Physik. Bibliothek*, Bd. 68.) 58 p. Leipzig, TEUBNER, 1927.

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Levi, Adolfo. La teoria stoica della verità e dell'errore. *Revue d'hist. de la philosophie*, 2, 113-132, 1928.

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Lévy, Isidore. Recherches sur les sources de la légende de PYTHAGORE. 152 p. (*Biblioth. de l'Ecole des hautes études, sc. religieuses*, 42). Paris, ERNEST LEROUX, 1926. (30 fr.)
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Reviewed by L. G., *Isis*, 10, 509, 1928.

Lévy, Isidore. La légende de PYTHAGORE de Grèce en Palestine 352 p. (*Bibl. de l'Ecole des hautes études, sc. histor. et philosoph.*, 252) Paris, H. CHAMPION, 1927. (75 fr.)
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Reviewed by L. G., *Isis*, 10, 509, 1928.

Reitzenstein, Richard. Die hellenistischen Mysterienreligionen nach ihren Grundgedanken und Wirkungen. 3. erw. und umgearb. Aufl. VII + 438 S. Leipzig, TEUBNER, 1927.
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Reviewed by MARTIN P. NILSSON, *Deutsche Literaturzeitung*, 5, 1649-1653, 1928.

Scoon, Robert. Greek philosophy before PLATO. VIII + 353 p. Princeton, University Press, 1928.
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Swoboda, Heinrich (1856-1926). Epitymbion. HEINRICH SWOBODA dargestellt. XIV + 385 p. Reichenberg, STIEPEL, 1927.
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Reviewed in *Journal des Savants*, 127, 1928.

Tarn, W. W. Hellenistic civilization. VIII + 312 p. London, ARNOLD, 1928.
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5. — ROME.

Abbott, Frank Frost (1860-1924); **Johnson, Allan Chester.** Municipal administration in the Roman Empire. VII + 599 p. Princeton, University Press, 1926
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Reviewed by MAURICE BESNIER, *Journal des Savants*, 292-3, 1928.

Beyer, Oscar. Die Katakombenwelt. Grundriss, Ursprung und Idee der Kunst in der römischen Christengemeinde. 153 p., 30 pl., 17 fig. in text. Tübingen, MOHR, 1927.
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Carcopino, Jérôme. Etudes romaines : la basilique pythagoricienne de la Porte Majeure. 414 p., pl. Paris, Artisan du Livre, 1926.
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Cavaignac, Eugène. La paix Romaine. (Histoire du Monde) 492 p. Paris, BOCCARD, 1928.
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Reviewed by TENNEY FRANK, *American Historical Review*, 34, 153, 1928.

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ISIS

L'auteur s'élève contre le préjugé tenace qui fait considérer comme des ignorants les médecins de la Rome antique, en passant en revue, très sommairement quelques célèbres médecins : A. MUSA, C. A. CELSUS, etc., leur clientèle (il s'occupe à ce point de vue à peu près uniquement des empereurs), leurs connaissances en médecine générale (d'après CELSE surtout), et en chirurgie (5 p. seulement). L'index bibliographique n'est qu'un trompe-l'œil.

L. G.

Rostovtzeff, Michael I. *Mystic Italy.* (The Colver Lectures, 1927, Brown University.) XXII + 176 p. New York, HOLT, 1927. ISIS.

Reviewed by CLIFFORD H. MOORE, *American Historical Review*, 34, 101-2, 1928.

Wenger, Léopold. *Der heutige Stand der römischen Rechtswissenschaft : erreichte und estrebtes (Münchener Beiträge zur Papyrusforschung und antiken Rechtsgeschichte, XI).* x + 113 p. München, BECK, 1927. ISIS

II. MIDDLE AGES.

6. — MIDDLE AGES (*generalities*).

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Reviewed by HENRI GOELZER, *Journal des Savants*, 220-25, 1928.

Hauberg, Poul. *Salernskolen og dens Indflydelse paa dansk medicinsk Literatur. (Archiv for Pharmaci og Chemi)* 1928. ISIS

The old Danish medical literature was compiled from a great many sources. Among these the following Salernitans : GARIOPONTUS, PETRONCELLUS, CONSTANTINUS AFRICANUS, BARTHOLOMEUS, TROTULA, ARCHIMATTHEUS, NICOLAUS SALERNITANUS, MATTHAEUS PLATEARIUS, JOHANNES FERRARIUS, BENVENUTUS GRAPHEUS, ROGER and GUALTERIUS AGULINUS. But also some of the anonymous Salernitan works were used : *Regimen sanitatis*, *Tractatus de aegritudinum curatione* and *Speculum medicorum*. J. W. S. J.

Hirschfeld, Ernst. *Deontologische Texte des frühen Mittelalters. Archiv für Geschichte der Medizin*, 20, 353-71, 1928. ISIS

Horwitz, Hugo Th. Technische Darstellungen aus alten Miniaturwerken. *Beiträge zur Geschichte der Technik und Industrie*, 10, 175-78, 7 fig., 1920. ISIS

Sarton, George. Tacuinum, Taqwīm. With a digression on the word almanac. (Answer 10) *Isis*, 10, 490-3, 1928. ISIS

Seyfert, Werner. Ein Komplexionentext einer Leipziger Inkunabel • (angeblich eines JOHANN VON NEUHAUS) und seine handschriftliche Herleitung aus der Zeit nach 1300. *Archiv für Geschichte der Medizin*, 20, 272-99, 372-89, 1 Fig., 1 Taf., 1928. ISIS

Strecker, Karl. Einführung in das Mittellatein. 42 S. Berlin, WEIDMANN, 1928. ISIS

Reviewed by PAUL LEHMANN, *Deutsche Literaturzeitung*, 5, 1658-1661, 1928.

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Reviewed by E. E., *American Historical Review*, 34, 104-6, 1928.

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Wickersheimer, Ernest. La question du judéo-arabisme à Montpellier, *Janus*, 31, 463-73, 1927. ISIS

Contrairement à l'opinion courante, ni les Juifs, ni les Arabes n'ont contribué à la formation de l'école de Montpellier; dans aucune des pièces par lesquelles il est possible de reconstituer le passé de la vieille université depuis sa fondation en 1220, il n'est cité un seul Juif, un seul Sarrazin. L. G.

Wickersheimer, E. Médecins et chirurgiens dans les hopitaux du Moyen Age. *Janus*, 32, 1-11, 1928. ISIS

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Willard, James F. Progress of mediaeval studies in the United States of America. Bulletin No. 6, 76 p. Published annually by the Mediaeval Academy of America and the University of Colorado, Boulder, Colorado, May 1928. ISIS

III. ORIENTAL SCIENCE AND CIVILIZATION.

8. — ASIA.

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Reviewed by S. RONZEVALLÉ, *Mélanges de l'université Saint-Joseph*, 12 225-247, 1927.

Macler, Frédéric. Trois conférences sur l'Arménie, faites à l'Université de Strasbourg. 144 p., 32 pl. (*Annales du Musée Guimet*, Bib. de Vulg., t. 46). Paris GEUTHNER, 1927. ISIS

Smith, Robert Payne. Supplement to the Thesaurus Syriacus. Collected and arranged by his daughter, J. P. MARGOLIOUTH. XIX + 345 p. Oxford, Clarendon, Press, 1927. ISIS

Reviewed by M. GASTER, in *Journal of the Royal Asiatic Society*, 697, 1928.

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Central Asia.

Barthold, W. Turkestan down to the Mongol invasion. (Second edition). Translated from the original Russian and revised by the Author with the assistance of H. A. R. GIBB. XX + 514 p. For the Trustees of the E. J. W. GIBB Memorial. London, LUZAC, 1928. ISIS

David-Neel, Alexandra. My journey to Lhasa. Illustrated with many photographs taken by the author. London, HEINEMANN, 1927. ISIS

Reviewed by H. LESS SHUTTLEWORTH, *Journal Royal Asiatic Society*, 160-3, 1928.

Gavrilov, Michel. Les corps de métiers en Asie Centrale et leurs statuts (rissala). *Revue des Etudes Islamiques*, 209-30, 1928. ISIS

- Huber, E.** Die Einführung des Weinbaus in Chinesisch-Turkistan.
Die Umschau, 31, 528-33, 13 fig., 1927. ISIS

Eastern Asia.

(Including works relative to the whole of Buddhist Asia, or
to India, Central and Eastern Asia combined.)

- Jochelson, Waldemar.** Archaeological investigations in Kamchatka.
Octavo, VIII + 88 p., 84 fig. and maps. 19 pl. Washington, D. C.,
Carnegie Institution of Washington, 1928. ISIS

« This book is based on the author's field work conducted in Kamchatka in 1910-1911. While no traces of paleolithic man himself were discovered in Siberia many skeletal remains of neolithic man were found. The relation of the Siberian tribes, in the past and present, to the population of the Caucasus, Turkestan, Mongolia, Korea, China and Japan is also discussed. Thirteen ancient sites were excavated in Kamchatka, and the archaeological remains consisting of numerous stone and bone artifacts, stone lamps and of a peculiar kind of primitive pottery are comparatively described in this report. »

9. — INDIA

- Geddes, Arthur.** Au pays de Tagore. La civilisation rurale du Bengale occidental et ses facteurs géographiques. Préface de A. DEMANGEON.
235 p., 2 grav. dans le texte, 1 carte et 5 pl. hors texte. Paris, ARMAND COLIN, 1927. ISIS

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Part 1 : Introductory. XVIII + 517 p. Calcutta, Government of India
Central Publication Branch, 1927. ISIS

Excellent reviews, by R. L. TURNER, *Nature*, 121, 783-785, 1928, and in the *Journal of the Royal Asiatic Society*, 711-18, 1928.

- Guérinot, A.** La religion Djaina. Histoire, doctrine, culte, coutumes, institutions. 351 p., 25 pl. hors texte. Paris, GEUTHNER, 1926. ISIS

Reviewed by J. BACOT, *Journal des Savants*, 234, 1928, and by L. D. BARNETT, *Journal of the Royal Asiatic Society*, 673-74, 1928.

- Mookerji, Rasacharya Kaviraj Bhudeb.** Rasa-Jala-Nidhi : or Ocean of Indian chemistry and alchemy. Compiled in Sanskrit, with English translation by the Author. Vol. 1. v + xv + VIII + 350 + v p. Vol. 2. II + 5 + 8 + 10 + 296 + 23 p. Calcutta, The Author, 41a Grey Street, n.d. (1927?). ISIS

Reviewed by E. J. HOLMYARD, *Nature*, 121, 703, 1928.

Nell, Andreas. Ceylon (Sinhalese) olas or book manuscripts on early medicines and how they were made. *Annals of Medical History*, 10, 293-96, 1928. ISIS

Schmidt, Richard. Die moderne Kunst des Singens und die altindische Atemtechnik. *Ephemerides orientalis*, no. 33, 1-12, Leipzig, HARRASOWITZ, 1928. ISIS

Singh, Avadhesh Narayan. On the Indian method of root extraction. *Bull. of the Calcutta mathematical society*, 18, 123-40, 1927. ISIS

« In the course of the present paper it will be shown that BHĀSKARĀCHĀRYA's method of extracting square roots is the same as CATANEO's (1546), and that it was given by the Indian mathematician ĀRYABHAṬA as early as 499 A. D. On the other hand, the method given by THEON OF ALEXANDRIA does not in the least resemble CATANEO's method. » Erroneous views on this subject have been published by G. R. KAYE and repeated by D. E. SMITH and F. CAJORI. The author discusses the question on the basis of the original texts quoted and retranslated by him. He ends his analysis as follows : « The ancient Greeks did not possess methods for the extraction of square and cube roots in any way resembling our present methods, so that, on the evidence at hand, one is forced to conclude that we are indebted to the ancient Indian mathematicians for our present methods of extracting square and cube roots, and that the methods were well known among the Indian mathematicians about 499 A. D., and there is every reason to believe that they were invented much earlier. » G. S.

Vogel, J. Ph. Annual bibliography of Indian archaeology for the year 1926. Published with the aid of the Government of Netherlands India. (Kern Institute — Leyden). x + 107 p., 12 pl. Leiden, BRILL, 1928. ISIS

This splendid bibliography, of which this is the first volume, does not deal only with India and Ceylon, but as well with Further India and adjoining territories (Central Asia, Far East). It is splendidly illustrated (12 plates). An introduction of 28 pages presumably written by the general editor, Dr. VOGEL (see *Isis*, 10, 234) calls attention to some of the outstanding excavations and publications. This is an excellent feature. Dr. VOGEL is assisted by two of his colleagues at the University of Leyden, N. J. KROM and J. H. KRAMERS and by a committee of honorary editors. May this volume be succeeded by many others. G. S.

10. — CHINA.

Hackmann, Heinrich. Chinesische Philosophie. (*Gesch. der Philos. in Einzeldarstellgn.* hrsg. von G. KAFKA, Abt. 1, Bd. 5.) 406 p., 1 pl. München, E. REINHARDT, 1927. ISIS

Reviewed by ALFRED FORKE, *Deutsche Literaturzeitung*, 899-902, 1928.

Hu, Suh. The development of the logical method in ancient China

by HU SHIH (SUH HU). 10 + 187 p. (*Thesis*, Columbia) Shanghai, Oriental Book Co., 1922. ISIS

Laufer, Berthold. Insect-musicians and cricket champions of China. 27 p., 12 pl., in photogravure. (*Anthropology Leaflet*, 22). Chicago, Field Museum of Natural History, 1927. ISIS
Reviewed by G. S., *Isis*, 10, 510-11, 1928.

Maspero, Henri. *La Chine antique.* (*Histoire du Monde*, edited by E. CAVAIGNAC, vol. 4.) XVI + 624 p. Paris, BOCCARD, 1927. ISIS
Reviewed by B. LAUFER, *American Historical Review*, 33, 903, 1928.

Mikami, Yoshio. Characteristics of Chinese mathematics (in Japanese). *Tôkyô Gakuhô*, 15, 431-484; 16, 49-109, Tokyo, 1926. ISIS
Reviewed by DAVID EUGENE SMITH, *Isis*, 10, 80-2, 1928.

Suzuki, Daisetz Teitaro. *Essays in Zen Buddhism. (First Series).* London, LUZAC, 1927. ISIS
Reviewed by EDWARD J. THOMAS, *Journal Royal Asiatic Society*, 174-5, 1928.

11. — JAPAN.

(**Japan, science**) Scientific Japan, past and present. Prepared in connection with the third Pan-Pacific Science Congress, Tokyo, 1926. XII + 359 p., 47 pl., 3 maps. Tokyo, MARUZEN Co., 1926. ISIS
Reviewed by GEORGE SARTON, *Isis*, 10, 83-88, 1928.

Montandon, George. *Au pays des Aïnou. Exploration anthropologique.* 241 p., 115 fig., 3 cartes et 48 pl. Paris, MASSON, 1927.

Nitobé, Inazo. *Le Bushidô.* Trad. de CH. JACOB, préface de A. BELLESORT. 266 p. Paris, PAYOT, 1927. ISIS

Otsuki, Nyoden. *Shinsen Yôgaku Nempyô* (Newly revised chronological table of Occidental learning in Japan). In Japanese. xvi + 158 p. Tokyo, 1927. ISIS
Reviewed by YOSHIO MIKAMI, *Isis*, 10, 82-3, 1928.

Tanakadate, A. Circumstances of introducing Roman characters to Japanese writing. *Bulletin des Relations Scientifiques* 3, 1-16, 1928. ISIS

Witte, Johannes. *Japan zwischen zwei Kulturen.* XII + 505 p. Leipzig, HINRICHS, 1928. ISIS
Reviewed by L. RIESS, *Deutsche Literaturzeitung*, 5, 1916-1920, 1928.

12. — ISRAEL

Baglioni, Silvestro. L'igiene sessuale nel Pentateuco. *Rassegna di studi sessuali*, 8, 1-8, 1928. ISIS

Blondheim, D. S. Les parlers Judéo-Romans et la Vetus Latina. Etude sur les rapports entre les traductions bibliques en langue romane des Juifs au moyen-âge et les anciennes versions. CXXXVIII + 247 p. Paris, EDOUARD CHAMPION, 1925. ISIS

Elaborate review by LUDWIG BLAU (of Budapest) in the *Jewish Quarterly Review*, 19, 157-182, 1928.

Dalman, Gustaf. Arbeit und Sitte in Palästina. Bd. I : Jahreslauf und Tageslauf. 1. Hälfte : Herbst und Winter. (*Schriften des Dtsch. Palästina-Inst.*, hrsg. von G. DALMAN. 3. Bd., 1. Hälfte). XIV + 279 p., 37 fig. Gütersloh, C. BERTELSMANN, 1928. ISIS

Reviewed by LUDWIG KÖHLER, *Deutsche Literaturzeitung*, 1077-1079, 1928.

Heman, Carl Friedrich. Geschichte des jüdischen Volkes seit der Zerstörung Jerusalems. In 2., gekürzter und bis auf die Gegenwart fortgeführter Auflage hrsg. von O. von HARLING. 444 p. Stuttgart, Calwer Vereinsbuchhdlg., 1927. ISIS

Reviewed by W. STAERK, *Deutsche Literaturzeitung*, 1145-1146, 1928.

Sassoon, David S. The history of the Jews in Basra. *The Jewish quarterly review*, 17, 407-69, 5 ill., 1927. ISIS

14. — ISLAM

Alexander, Constance M. Baghdad in bygone days. From the journal and correspondence of CLAUDIUS RICH, traveller, artist, linguist, antiquary, and British resident at Baghdad, 1808-1821, XVI + 336 p. London, MURRAY, 1928. ISIS

Canaan, Taufiq. Muhammadan saints and sanctuaries in Palestine. Reprint from the *Journal of the Palestine Oriental Society*. VIII + 331 p. London, LUZAC, 1927. ISIS

Reviewed by R. P. DEWHURST in *Journal of the Royal Asiatic Society*, 693-94, 1928 and by LUDWIG KÖHLER in *Deutsche Literaturzeitung*, 1325-26, 1928.

Gautier, E. F. L'Islamisation de l'Afrique du Nord : les siècles obscurs du Maghreb. 432 p., ill. Paris, PAYOT, 1927. ISIS

Reviewed in *Geographical Review*, 514-16, July 1928.

Goichon, A. M. La vie féminine au Mzab. Etude de sociologie Musulmane. Préface de WILLIAM MARÇAIS, XIV + 345 p., 19 pl. Paris, GEUTHNER, 1927. ISIS

Menzel, Theodor. Der I. Turkologische Kongress in Baku. 26, II. bis 6. III. 1926. *Der Islam*, 16, 1-76, 169-228, 1927. ISIS

Mercier, Louis. La chasse et les sports chez les Arabes. Illustrations de l'auteur d'après des miniatures orientales. 256 p. Paris, MARCEL RIVIÈRE, 1927. (20 fr.) ISIS
Reviewed by GEORGE SARTON, *Isis*, 10, 511-13, 1928.

Migeon, Gaston. Manuel d'art musulman. II. Les arts plastiques et industriels. 2 vols. 440; 460 p., 462 fig. Paris, PICARD, 1927. ISIS

Ruska, Julius. Zur geographischen Literatur im islamischen Kulturbereich. *Geogr. Z.*, 33, 519-28, 589-99, 1927. ISIS

Smirnov, Vasili Dimitriyevich (1846-1922). A memoir, by N. K. DMITRIYEV, *Journal Royal Asiatic Society*, 408-10, 1928. ISIS
Russian student of Ottoman Turkish literature.

PART III.

SYSTEMATIC CLASSIFICATION.

Including only the material which could not be included in Parts I and II. Hence studies on Japanese astronomy or on XIIIth century astronomy are not classified below under astronomy, but above, respectively under Japan (in Part II) and XIIIth Century (in Part I).

The sections forming Part III are classified as follows:

- I. *Science in general* : 15. Bibliography; 16. History; 17. Organization; 18. Philosophy.
- II. *Formal sciences* (Knowledge of forms) : 19. Logic and Theory of Knowledge; 20. Mathematics; 21. Statistical methods.
- III. *Physical sciences* (Knowledge of inorganic nature); 22. Mechanics; 23. Astronomy; 24. Physics; 25. Chemistry (Physico-chemistry, Industrial chemistry); 26. Technology.
- IV. *Biological sciences* (Knowledge of organic nature) : 27. Biology (Generalities, « Natural history »); 28. Botany (Agronomy, Phytopathology, Palaeobotany); 29. Zoology.
- V. *Sciences of the earth* (implying knowledge of both organic and inorganic nature): 30. Geodesy; 31. Geography and Oceanography; 32. Geology, Mineralogy, Palaeontology, Mining; 33. Meteorology, Climatology and Terrestrial Physics.
- VI. *Anthropological and historical sciences* (Knowledge of man, past and present): 34. Anatomy; 35. Physical anthropology (anthropometry

and races of man); 36. Physiology (human and comparative); 37. Psychology (human and comparative); 38. Archaeology (generalities, methods); 39. Prehistory; 40. Ethnology (primitive and popular science); 41. Superstition and Occultism.

42. Economics (economic doctrines and history; commerce; transportation and communications); 43. Sociology, Jurisprudence and Positive Polity; 44. History of Civilization (general history, historical methods, biography and chronology); 45. History of Art (Art and science; Iconography; Arts and crafts); 46. History of Language, Writing and Literature; 47. History of Morals (Moral organization of society); 48. History of Philosophy; 49. History of Religion (Science and religion).

VII. *Medicine*: 50. History, organization and philosophy of medicine; 51. Epidemiology, History of special diseases. Public health and Social medicine; 52. History of hospitals and of medical teaching; 53. Pharmacy; Pharmacology; Toxicology.

VIII. *Education* (The methods of accumulating, imparting and diffusing knowledge); 54. Education (Generalities, Methods, Colleges, Universities); 55. Academies, societies, congresses, National and international organization of science; 56. Bibliography. (Methods, Libraries); 57. Museology (Museums and Collections).

IX. 58. *Alia*; 59. *Errata*.

The applied sciences are not disconnected from the pure sciences, but, as far as possible, the principles and applications of science are considered in the same section. However, applications based upon the principles of many sciences are dealt with separately (e. g., technology; medicine; education).

I. SCIENCE IN GENERAL

16. — HISTORY OF SCIENCE.

Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik. *Isis*, 10, 57, 1928. ISIS

Barnes, Harry Elmer. The history of science, teaching and personalia. *Isis*, 10, 47-52, 1928. ISIS

(Binoux, Prix) Le prix de 1927 a été décerné à HENRI DAUDIN. *Isis*, 10, 58, 502-05, 1928. ISIS

Cittert, van. Historische Tentoonstelling van antieke, natuurkundige Instrumenten te Utrecht. *Bijdragen tot de geschiedenis der geneeskunde* 8, 147-148, 1928. ISIS

(History of Science Society). List of members of the history of science society elected from August 1, 1926 to July 31, 1927. *Isis*, 10, 7-10, 1928. ISIS

(History of Science Society). Report of the meeting and exhibition commemorating the bi-centenary of the death of Sir ISAAC NEWTON. *Isis*, 10, 333-37, 1928. ISIS

(History of Science Society). Proceedings of the council meeting of the History of Science Society. *Isis*, 10, 338-9, 1928. ISIS

Meyer, Adolf. *Naturforschung und Naturlehre im alten Hamburg.* VIII + 99 S., 8 Taf. Hamburg, Staats-Bibliothek, 1928. ISIS

Contents : I. Hamburger Naturforscher und ihre Werke. Eine biobibliographische Übersicht. (1) Das Zeitalter von JOACHIM JUNGIIUS und die erste Blütezeit des Akademischen Gymnasiums. (2) Die Zeit der Naturtheologie und der Aufklärung, zugleich die zweite Blütezeit des Akademischen Gymnasiums. Anhang : Zeitschriften und Sammlungen. II. JOACHIM JUNGIIUS' geistesgeschichtliche Gestalt. Abhandlung von ADOLF MEYER.

The first part contains valuable bio- and bibliographical notes on a number of men of science who were born or flourished in the great city of Hamburg. A splendid group of men ! Fine portraits of JOACHIM JUNGIIUS, PAUL MARQUARD SCHLEGEL, JOHANN VAGETIUS, JOHANN GEORG BÜSCH, J. A. H. REIMARUS. G. S.

Ruska, Julius. *Forschungsinstitut für Geschichte der Naturwissenschaften in Berlin. Erster Jahresbericht. Mit einer wissenschaftlichen Beilage über die Aufgaben eines Forschungsinstituts für Geschichte der Naturwissenschaften.* 24 p. Berlin, SPRINGER, 1928. ISIS

Sarton, George. *Introduction to the history of science* Vol. 1, From HOMER to OMAR KHAYYAM. XII + 839 p. (Carnegie Institution of Washington, Publication no. 376). Baltimore, WILLIAMS and WILKINS, 1927. (\$ 10.) London, BAILLIERE, TINDALL and COX, 1927. (45 sh.)

ISIS

Reviewed by J. BIDEZ : *Revue belge de philologie et d'histoire*, 7, 341, 1928; I. B. HART in *Science Progress*, Oct 1928, 363-66; by CHARLES H. HASKINS. *Isis*, 10, 88-92, 1928; by Graf CARL V. KLINCKOWSTROEM in *Unsere Welt* (20, 134-137, Bielefeld, 1928); by RAYMOND LENOIR in *Revue philosophique* (53, 310, 1928); by P. MASSON-OURSSEL in *Mercure de France*, 15 août 1928, p. 148-150; by Dr. MIRCEARLIADÉ in *Cuvântul* (Buckarest, June 1928); by JULIUS RUSKA in *Der Islam*, 17, 364-65, 1928, See also *Isis*, 11, 234, 519.

Sarton, George. *Medallic illustrations of the history of science.* (First series : XIXth and XXth centuries). Fourth article. *Isis*, 10, 485-88, 4 pl. 1928. ISIS

Medals representing LEVERRIER, GULDBERG, ALEX. AGASSIZ, STOKES, and DUPIN.

Sarton, George. *Twenty second critical bibliography of the history and philosophy of science and of the history of civilization (to May 1927).* *Isis*, 10, 103-327, 1928. ISIS

Singer, Charles. *From magic to science : essays on the scientific twilight.* XIX + 253 p., 47 pl. London, ERNEST BENN, 1928. ISIS

Smith, G. Elliot. Conversion in science. *Nature*, 121, 750-53, 1928.

ISIS

From the Huxley Memorial Lecture, delivered at the Royal College of Science, South Kensington, on May 4.

17. — ORGANIZATION OF SCIENCE.

(Internal organization is meant, see *Isis* 1, 195. For external, national or international, organization, see section 55).

Brauer, Ludolph. Ueber die Bedeutung freier Forschungsinstitute. *Beiträge zur Klinik der Tuberkulose und spezifischen Tuberkulose-Forschung*, 68, 671-679, 1928.

ISIS

Zimmern, Alfred. Learning and leadership; a study of the needs and possibilities of international cooperation. 112 p. London, Oxford University Press, 1928.

ISIS

18. — PHILOSOPHY OF SCIENCE.

Hellmund, Heinrich. Das Wesen der Welt. 1323 p. Zürich, Amalthea-Verlag, 1927.

ISIS

Inhalt : 1. Erkenntniskritische Einleitung zur Metaphysik; 2. Die Metaphysik der Physik; 3. Die Metaphysik der Chemie; 4. Die Metaphysik der Biologie; 5. Die Metaphysik der Psychologie; 6. Die Metaphysik der Ethik; 7. Die Metaphysik der Soziologie; 8. Die Metaphysik der Politik; 9. Die Metaphysik der Geschichte; 10. Die Metaphysik der Religion; 11. Die Metaphysik der Pädagogik; 12. Die Metaphysik der Geschlechter; 13. Die Metaphysik der Aesthetik; 14. Die Metaphysik des Genius; 15. Die Metaphysik der Gegenwart; 16. Die Metaphysik des deutschen Wesens.

« Dieses Buch will nicht um jeden Preis original sein — sondern es will *wahr* sein. Es will wieder den Blick auf Dinge hinlenken, die sich infolge der Spezialisierung und Trennung der allgemeinen Aufmerksamkeit ganz entzogen zu haben scheinen, nämlich : auf das *Verbindende*, Gemeinschaftliche. Das Buch sucht zu zeigen, dass das *Gemeinsame tiefer sitzt* und mehr Wahrheitsgehalt in sich birgt als das *Trennende* — dass im Gemeinschaftlichen allein die Quellen allen Lebens und aller Werte wurzeln. Es strebt vom Gemeinsam-Wesentlichen aus eine Neu-Befruchtung, Verlebendigung und innige Verbindung aller Wissens- und Lebensgebiete an. Wer mit dieser Absicht einig geht, dem wird es, denke ich, etwas sagen. Das Buch sucht davon zu überzeugen, dass es ein gemeinsames Wesen, ein Unvergängliches, Unantastbares in allem Seienden *gibt* und dass dieses sich klar *aussprechen lässt* — nicht mit allgemeinen, verschwommenen Redensarten, sondern durch verstehendes und doch exaktes Eindringen in die Materie aller Wissensgebiete. Dies allein gilt ihm als das 'Metaphysische', 'Absolute'. Das Buch will die eine, in allem Sein enthaltene *Struktur der Welt* sichtbar machen — und zwar mehr als dies bis heute meines Erachtens geschehen ist — und auf diese Weise die exakte Wissenschaft mit demjenigen, dem sie sich bisher meist verschloss und entzog, mit dem Vereinigenden selbst streng

verknüpfen. Es sucht wissenschaftlich zu bleiben und doch dem Ewigen, Unzerstörbaren, das bisher meist nur gefühls- und ahnungsweise das Gemüt der Menschen erfüllte, einen sicheren Platz anzuweisen, von dem es sich nicht mehr vertreiben lässt. Es möchte, indem es *eine Orientierung über das Ganze der Welt* und seine immanente Gesetzlichkeit bietet, die beiden Seiten des menschlichen Geistes, die rationale und die irrationale, die sich bisher stets befehlen, miteinander zur Deckung bringen und untrennbar verschmelzen. Und darüber hinaus sucht es, praktisch, eben so etwas wie einen festen, sicheren Pol ins Leben hineinzustellen, an dem die verirrte, ruhelose Seele Wurzel zu schlagen vermag.»

Ritter, William E. and Bailey, Edna W. The organismal conception, its place in science and its bearing on philosophy. *University of California Publications in Zoology*, vol. 31, p. 307-58, 1928. ISIS

Part I: Place of the organismal conception in science. Cellular biology; protoplasmic physiology; genetical biology; respiratory biology; neural biology; endocrinology; psychology; sciences of inanimate nature. Part 2. Bearing of the organismal conception on philosophy.

Tannery, Paul (1843-1904). *Mémoires scientifiques. Volume VIII. Philosophie moderne. 1876-1903.* Edité par J. L. HEIBERG. xv + 413 p. Toulouse, EDOUARD PRIVAT, 1927. ISIS

Reviewed by GEORGE SARTON, *Isis*, 10, 92-4, 1928.

Wolf, Abraham. *Essentials of scientific method.* Second edition, revised and enlarged. 174 p. London, GEORGE ALLEN and UNWIN, 1928. ISIS

II. FORMAL SCIENCES

(Knowledge of Forms).

19. — LOGIC AND THEORY OF KNOWLEDGE.

Whitehead, A. N. and Russell, Bertrand. *Principia mathematica.* Second edition. Vol. II, pp. xxi + 742, Vol. III, pp. 491. Cambridge, University Press, 1927. ISIS

Reviewed by C. H. LANGFORD, *Isis*, 10, 513-19, 1928.

20. — MATHEMATICS.

Brauner, Ludwig. *Wichtige Abschnitte in der Rechenmaschinen-Entwicklung. Beiträge zur Geschichte der Technik und Industrie,* 16, 248-60, 9 fig., 1926. ISIS

Cajori, Florian. *Mathematics in liberal education. A critical examination of the judgments of prominent men of the ages.* 169 p. Boston. The Christopher Publishing House, 1928. ISIS

This is essentially a collection of quotations from the writings of philosophers and scientists of all times dealing with the educational value of mathematics. Each group of quotations is followed by a summary. This selection is very rich and very eclectic; it contains adverse judgments, as well as favorable ones. This is completed by brief discussions and statistical summaries. The grand total is 603 judgments for, and 128 against, the high value of mathematical study in liberal education. (If professional mathematicians were excluded, the total vote would be 413 to 123). A very valuable little book. May it influence American educators and help them realize the fundamental importance of mathematical training. G. S.

Cajori, Florian. A history of elementary mathematics with hints on methods of teaching. Illustrated Japanese translation by K. OGURA and Y. IDE. 510 p., Tokyo, Sank do, 1928. (Five yen). ISIS

CAJORI's History of elementary mathematics was first published by MACMILLAN, New York, in 1897 (VIII + 304 p.); a revised and enlarged edition (VIII + 324 p.) was issued by the same publishers in 1917. It is that second edition which is here translated into Japanese, with the addition of notes by the learned translators. Dr. K. OGURA is an able mathematician, who is now the director of the Shiomi Laboratory of Osaba. A very remarkable feature of this translation is the abundant collection of well chosen illustrations: portraits, facsimiles, monuments, illustrating every aspect of the development of mathematics. Some of these illustrations were new to me! This work, completed by an elaborate index, seems to have been done with considerable care. It is a very handsome volume which does credit to the publishers as well as to the authors. G. S.

Feldhaus, F. M. Rechenapparate mit Kugeln oder Knöpfen. 3. Euklid-Feldhaus-Beilage zur «Maschinen-Buchhaltung», S. 9-12, Zella Mehlis in Thüringen, Juni 1928. ISIS

Hamel, Georg. Ueber die philosophische Stellung der Mathematik. *Akad. Schriftenreihe der Techn. Hochsch. Charlottenburg*, Heft 1. 16 S. Verlag Studentenhaus Charlottenburg E. V., 1928. ISIS

In dieser Rektoratsrede (30. VI. 1928) vertritt HAMEL vor allem den Gedanken, dass es notwendig erscheint, den Kant'schen Begriff der «reinen Anschauung» im Sinne der Friesschen Philosophie explizit durchzuarbeiten, um ein wirkliche Grundlage der Mathematik zu erhalten, welche weder die empirische Anschauung noch die Logik allein geben können. H. W.

Hancock, Harris. The analogy of the theory of KUMMER's ideal numbers with chemistry and its prototype in PLATO's concept of idea and number. *The American mathematical monthly*, 35, 282-290, 1928. ISIS

Junge, Gustav. Einführung in Wesen und Wert der Mathematik. (*Wissen und Wirken*, Bd. 56). 92 S. Karlsruhe, G. BRAUN, 1928. ISIS

Ein hübsches Büchlein, das sich besonders durch die starke Heranziehung der dem Verf. vertrauten griechischen Mathematik auszeichnet. H. W.

- Löffler, E.** Forschung und Schule. Denkmittel der Mathematik im Dienste anderer Wissenschaften. *Unterrichtsblätter für Mathematik und Naturwissenschaften*, 34, 225-34, 1928. ISIS

- Loomis, Elisha Scott.** The Pythagorean proposition. 214 p. Cleveland, Masters and Wardens Association of the 22nd Masonic District of the Most Worshipful Grand Lodge of Free and Accepted Masons of Ohio, 1928. ISIS

Reviewed by RALPH D. BEETLE, *The American mathematical monthly*, 35, 310-11, 1928.

- Miller, G. A.** Origin of our present mathematics. *Scientific Monthly*, 26, 295-98, 1928. ISIS

More than half of the mathematics of today has been developed since the beginning of the nineteenth century. These developments include a considerable part, but less than half, of what is commonly known as elementary mathematics.

- Pastori, Maria.** Le serie divergenti. *Period. di mat.* (4) 7, 302-320, 1928. ISIS

- Smith, David Eugene.** A source book in the history of mathematics. *The American mathematical monthly*, 35, 280-2, 1928. ISIS

- Stammler, Gerhard.** Der Begriff der Null und der negativen ganzen Zahlen. Ein Beitrag zur Grundlegung der Arithmetik. Im Anschluss an den Aufsatz von W. KOPPELMANN: « Ist die Arithmetik ein logisch korrektes Lehrgebäude? » *Ann. d. Philos.*, 7 S. 146-164 (1928). ISIS

Der Aufsatz von KOPPELMANN war im denselben *Annalen* Bd. VI, S. 28 ff. erschienen. Ihm gegenüber zeigt STAMMLER, dass wenn man die ganz moderne Grundlegung der Arithmetik untersucht, sie sich als logisch völlig einwandfrei erweist. H. W.

- Vries, Hendrik de.** Die vierte Dimension. Eine Einführung in das vergleichende Studium der verschiedenen Geometrien. Übers. nach der 2. Aufl. von RUTH STRUIK. (*Wiss. und Hypoth.*, 29) IX + 167 p., 35 fig. Leipzig, Berlin, B. G. TEUBNER, 1926. ISIS

Reviewed by H. HOPF, *Deutsche Literaturzeitung*, 1230-1231, 1928.

- Wieleitner, Heinrich.** Mathematische Quellenbücher. III. Analytische und synthetische Geometrie. VII + 90 S., 22 Abb. Berlin, O. SALLE, 1928. (Rm. 2.50) ISIS

I have said how good WIELEITNER's mathematical anthology was when I reviewed the first two parts (*Isis*, 11, 240). The third part, dealing with analytic and synthetic geometry is equally good. The first three extracts

are taken from APOLLONIOS. Then we make a jump of two thousand years to reach FERMAT. The rest of the book contains extracts from DESCARTES, FLORIMOND DE BEAUNE, F. VAN SCHOOTEN, DE LA HIRE, DE L'HOSPITAL, EULER, DESARGUES, PASCAL, PONCELET, MÖBIUS, STEINER. G. S.

III. PHYSICAL SCIENCES

(Knowledge of inorganic nature).

22. — MECHANICS.

(Including celestial and atomical mechanics).

Feld, Jacob. History of the development of lateral earth pressure theories. *Brooklyn Engineers' Club Proceedings*, 61-104, January 1928.

ISIS

Contents : 1. Theories previous to 1773. 2. Development of the theory of the wedge of maximum pressure, 1773-1840, COULOMB to PONCELET. 3. Elementary and wedge theories disregarding the wedge of maximum pressure, 1773 to date. 4. Recent development of the theory of the wedge of maximum pressure, 1840 to date, REBHANN and WEYRAUCH. 5. Theory of the ellipse of stress, 1856, RANKINE. 6. Theory of the circle of stress, 1870, MOHR and WEYRAUCH. 7. Analytical stress theories, 1873, to date, LEVY, ST. VENANT and BOUSSINESQ. 8. Recent theories based upon the laws of energy, friction and elasticity. G. S.

Metz, André. Temps, Espace, Relativité. 211 p. (Science et philosophie). Paris, GABRIEL BEAUCHESNE, 1928.

ISIS

Avec son talent habituel, l'auteur de cet excellent petit livre permet, aux personnes douées d'une bonne culture scientifique, sinon de pénétrer sans effort dans une théorie mathématique extrêmement difficile d'accès, du moins de se familiariser avec les nouvelles conceptions du temps, de l'espace, et de la masse qui résultent des doctrines de EINSTEIN et de ses disciples ; ces conceptions qui ont parfois scandalisé ou tout au moins étonné grand nombre d'ignorants ou même de savants, se dépouillent, à mesure que l'on y réfléchit, de leur caractère rébarbatif, étrange ou paradoxal ; et le lecteur de M. METZ qui n'a aucune qualité pour juger la valeur réelle de la relativité, encore discutée par quelques spécialistes, est du moins disposé à en accepter les principes, et cela sans révolte aucune. HÉLÈNE METZGER.

Michel, J. Mouvements perpétuels. Leur histoire et leurs particularités depuis les premières tentatives du XII^e s. jusqu'aux engins des inventeurs modernes. VIII + 52 p., 82 fig., DESFORGES, GIRARDOT, Paris, 1927.

ISIS

L'auteur, s'inspirant de ses prédécesseurs anglais, allemands (*Isis*, 3, 364), décrit plus ou moins sommairement 98 mécanismes chimériques qu'il groupe en : Mouvements perpétuels mécaniques, mouvements à circulation de fluide, mouvements magnétiques et électriques, et mouvements perpétuels divers (horlogerie à selfremontage, appareils à corps radioactifs, dispositifs

à air liquide). Le nombre des inventeurs de mouvements perpétuels est si grand que de 1855 à 1903, l'Angleterre aurait délivré 575 brevets pour machines à mouvements perpétuels. La brochure est malheureusement écrite en un très mauvais français.

L. G.

23. — ASTRONOMY.

Bell, Louis. Notes on the early evolution of the reflector. *Proceedings of the American Academy of Arts and Sciences*, 57, 67-74, Boston, 1922. ISIS

Jeans, J. H. Astronomy and cosmogony. x + 420 p. London, Cambridge University Press, 1928. ISIS

24. — PHYSICS.

Bachelard, Gaston. Etude sur l'évolution d'un problème de physique : la propagation thermique dans les solides. 184 p., Paris, J. VRIN, 1927. ISIS

L'auteur suit la question de la propagation de la chaleur dans les solides, au triple point de vue expérimental, mathématique et philosophique, depuis les premiers travaux de NEWTON (1701) jusqu'à BOUSSINESQ, à travers GUILLAUME AMONTONS, S'GRAVESANDE, BOERHAAVE, RICHMANN, LAMBERT, BLACK, LAVOISIER, LAPLACE, BIOT, FOURIER, POISSON, DUHAMEL, LAMÉ, etc. Ce travail est une illustration de son *Essai sur la connaissance approchée* (Isis, 11, 522).

L. G.

Buckley, H. A short history of physics. xi + 263 p. London, METHUEN, 1927. ISIS

Reviewed by A. G. C., *Nature*, 121, 823-24, 1928.

Disney, Alfred N. Origin and development of the microscope, as illustrated by catalogues of the instruments and accessories, in the collections of the Royal Microscopical Society, together with bibliographies of original authorities. In collaboration with CYRIL F. HILL and WILFRED E. WATSON BAKER. Preceded by an historical survey on the early progress of optical science by the editor. xi + 303 p., 36 fig., 30 pl. London, Royal Microscopical Society, 1928. ISIS

The historical introduction (152 p) is divided as follows : 1. Earliest times to 1590; 2. Optical instruments erroneously attributed to the ancients. This is a summary of a French paper published by THOMAS HENRI MARTIN in *Boncompagni Bulletino* (vol. 4, 165-238, 1871); 3. Age of progress, 1591-1660; 4. Invention of telescope and of compound microscope. Early form of latter; 5. Bibliography; in many cases the salient original passages are given in extenso. « Part II is occupied with catalogues of the instruments, and accessories, together with bibliography of the original authorities in the Library of the Royal Microscopical Society. As will be seen from the special

Introduction to the Second part, the year 1850 has been selected as a suitable date for separating early from modern microscopes. This at once gives two groups, A and B, of instruments. The accessories fall into a group C, by themselves. This is a very elaborate and useful work. Its value is still increased by abundant and well chosen illustrations. G. S.

Ewing, Sir James Alfred. A century of inventions. Supplement to *Nature*, 121, 947-55, 1928. ISIS

From the Thirty-fourth James Forrest Lecture, delivered before the Institution of Civil Engineers on June 4, 1928, on the occasion of the celebration of the centenary of its incorporation.

Hoppe, Edmund (1854-1928). Geschichte der Physik. (Handbuch der Physik, herausgegeben von H. GEIGER und KARL SCHEEL, vol. 1, p. 1-179). Berlin, JULIUS SPRINGER, 1926. ISIS

This work ought not to be confused with another by the same author, bearing the same title, and published in the same year — but in Brunswick. That other work, reviewed in *Isis*, 9, 571, was arranged according to topics; in this one, which is much shorter, the treatment is more strictly chronological. The book is divided as follows: I. Antiquity down to 1600. This includes chapters on Babylonian and Egyptian, Greek and Arabic physics, and on physics in mediaeval Christian Europe. All this is dealt with in less than 27 pages! II. Period 1600 to 1842. Divided into four sections: 1600 to 1727, 1727 to 1790, GALVANI to 1820, 1820 to 1842. In all, 98 pages. III. Period 1842-1895, 75 pages. This account has the same outstanding quality as the one published in Brunswick: the level of accuracy is remarkably high and the original sources are almost always quoted. It is followed by two short chapters: on physical literature (p. 180-86) by KARL SCHEEL, and on research and teaching by E. H. TIMERDING (187-208). There is an index of subjects, but not of proper names. G. S.

Millikan, Robert Andrews; Henry Gordon Gale, and Charles William Edwards. A first course in physics for colleges. XIII + 676 + XLII p., 583 fig., illustrations. Boston, GINN, 1928. (\$ 3.72).

It is hardly necessary to recommend a textbook which has been produced under the supervision of R. A. MILLIKAN and has been severely tested by a number of teachers in actual classroom experience. But it will be of special interest to our readers to know that the students using it will obtain a fair amount of historical knowledge. For example, the abundant illustrations include portraits of the leading physicists. G. S.

Rohr, Moritz von. Aus der Geschichte der Brille, mit besonderer Berücksichtigung der auf der Greeffschen beruhenden Jenaischen Sammlung. *Beiträge zur Geschichte der Technik und Industrie*, 17, 30-50, 20 fig., 1927. ISIS

25. — CHEMISTRY, PHYSICO-CHEMISTRY, INDUSTRIAL CHEMISTRY.

Färber, Eduard. Die geschichtliche Entwicklung der Chemie. *Beiträge zur Geschichte der Technik und Industrie*, 14, 50-64, 1924. ISIS

Färber, Eduard. Aus der Geschichte der chemischen Holzverwertung mit besonderer Berücksichtigung der Zellstoffgewinnung *Beiträge zur Geschichte der Technik und Industrie*, 16, 121-132, 1926. ISIS

Geisler, Kurt W. Zur Geschichte der Spirituserzeugung. Unter besonderer Berücksichtigung der landwirtschaftlichen Brennereien. *Beiträge zur Geschichte der Technik und Industrie*, 16, 94-105, 7 fig., 1926. ISIS

Holmyard, Eric John. The great chemists. VI + 137 p., frontispiece. London, METHUEN, 1928. (3/6) ISIS

Popular account which is of special interest, because it is the first which pays sufficient attention to the Muslim chemists, of which the author has made a special study. There is even a (suppositious) portrait of JABIR in frontispiece ! Contents : (1) ancient times ; (2) JABIR ; (3) RAZI and IBN SINA ; (4) ROGER BACON ; (5) PARACELUS ; (6) ROBERT BOYLE ; (7) GEORG ERNST STAHL ; (8) JOSEPH PRIESTLEY ; (9) ANTOINE LAURENT LAVOISIER ; (10) JOHN DALTON ; (11) AMEDEO AVOGADRO ; (12) Sir HUMPHREY DAVY ; (13) JUSTUS LIEBIG ; (14) FRIEDRICH AUGUST KEKULÉ ; (15) LOUIS PASTEUR ; (16) SVANTE ARRHENIUS ; (17) DMITRI IVANOVITCH MENDELÉEFF ; (18) Sir WILLIAM RAMSAY.

Janet, Charles. La structure du noyau de l'atome, considérée dans la classification périodique des éléments chimiques. 68 p., 3 pl. Impr. départementale de l'Oise. Beauvais, 1927. Essai de classification hélicoïdale des éléments chimiques. 104 p., 4 pl. id., 1928. ISIS

Komppa, Gust. Über ältere finnische Chemiker. *Zrschr. f. angew. Chemie*, 40, 1431-1434, 1927. ISIS

Reviewed by PAUL DIERGART, *Mitteilungen zur Geschichte der Medizin*, 27, 162, 1928.

Marchal, Germaine. Le Glucinium. L'historique de sa découverte, sa préparation et ses propriétés. *Revue générale des Sciences*, 39, 271-76, 1928. ISIS

Nakaseko, Rokuro. Sekai Kwagaku-shi (History of chemistry). v + 571 p., 31 photographs. Kyôto, KANIYA SHÔTEN, 1927. ISIS
Reviewed by MARCELLO MUCCIOLI, *Archeion*, 9, 379-82, 1928.

Newell, Lyman C. and Davis, Tenney L. Notable New England chemists. 16 p. portraits. Boston, 1928. ISIS

« This pamphlet was prepared by the Division of History of Chemistry, American Chemical Society. It was distributed to registered members of the Division at the Swampscott meeting of the Society, September 10-14, 1928. » Contains portraits and biographical sketches of fourteen chemists of New England from JOHN WINTHROP jr. to T. W. RICHARDS.

Partington, J. R. The composition of water. (Classics of scientific method, 4) VIII + 106 p., 10 fig., 6 pl. London, G. BELL, 1928. 1s. 6d.) ISIS

Contents : 1. Early views and experiments on water; 2. The researches of CAVENDISH; 3. CAVENDISH's apparatus; 4. The water controversy; 5. Analysis of water by LAVOISIER; 6. Synthesis of water by LAVOISIER; 7. PRIESTLEY's experiments on the reduction of oxides; 8. Synthesis of water by MONGE; 9. Composition of water by volume and weight : GAY-LUSSAC, HUMBOLDT; DUMAS, MORLEY; SCOTT; BURT and EDGAR; 10. Summary.

Plessner, Martin. Neue Materialien zur Geschichte der Tabula Smaragdina. *Der Islam*, 16, 77-113, 1927. ISIS

Schmieder, Karl Christoph (1778-1850). Geschichte der Alchemie. (1832) Herausgegeben und mit einer Einleitung versehen von FRANZ STRUNZ. 28 + x + 613 S. München-Planegg, BARTH, 1927. ISIS

Stones, G. B. The atomic view of matter in the XVth, XVIth, and XVII th centuries. *Isis*, 10, 445-65, 1928. ISIS

26. — TECHNOLOGY.

(For mining, see 32. geology; for industrial chemistry, 25. chemistry.
See also Arts and Crafts, under 45).

Berndt, G. Die Entwicklung der Schraubengewinde. *Beiträge zur Geschichte der Technik und Industrie*, 14, 101-120, 12 fig., 1924. ISIS

Bethge, Karl. Aus der Zeit der alten Weinpressen. *Beiträge zur Geschichte der Technik und Industrie*, 14, 210-216, 6 fig., 1924. ISIS

Buxbaum, Bertold. Der amerikanische Werkzeugmaschinen- und Werkzeugbau im 18. und 19. Jahrhundert. *Beiträge zur Geschichte der Technik und Industrie*, 10, 121-154, 25 fig., 1920. ISIS

Buxbaum, Bertold. Der englische Werkzeugmaschinen- und Werkzeugbau im 18. und 19. Jahrhundert. *Beiträge zur Geschichte der Technik und Industrie*, 11, 117-142, 32 fig., 1921. ISIS

Clark, H. O. Notes on local technology. *Transactions of the Newcomen Society*, 6, 184-7, 1926. ISIS

East Anglian technology : Flint industry ; monumental brasses ; engineering ; millwrighting.

Däbritz, W. Entstehung und Aufbau des rheinisch-westfälischen Industriebezirks. *Beiträge zur Geschichte der Technik und Industrie*, 15, 13-107, 31 fig., 1925. ISIS

Daniloff, Serge. Some unusual American spinning wheels. *Transactions of the Newcomen Society*, 6, 144-48, 1926. ISIS

Döhner, O. H. Die Entwicklung der Mechanisierung bei der Herstellung von Eisen- und Stahldrähten. *Beiträge zur Geschichte der Technik und Industrie*, 14, 193-204, 10 fig., 1924. ISIS

(Engineering, History) Analytical bibliography of the history of engineering and applied science, Part IV. *Transactions of the Newcomen Society*, 6, 203-21, 1926. ISIS

Häneke, Hans. Die technischen Museen, 1927. *Beiträge zur Geschichte der Technik und Industrie*, 17, 153-4, 1927. ISIS

Häneke, Hans. Aus der Geschichte der Zylinderbohrmaschine. *Beiträge zur Geschichte der Technik und Industrie*, 17, 117-121, 12 fig., 1927. ISIS

Hassler, Friedrich. Aus der Geschichte Augsburgs, seiner Gewerbe und seiner Industrie. *Beiträge zur Geschichte der Technik und Industrie*, 14, 155-192, 10 fig., 3 portr., 1924. ISIS

Hausen, J. Die Geschichte der Papierindustrie auf der Jahresschau Deutscher Arbeit, Dresden, 1927. *Beiträge zur Geschichte der Technik und Industrie*, 17, 154-5, 2 fig., 1927. ISIS

Hendrichs, Franz. Die Lage der Solinger Schwertindustrie vor tausend Jahren. *Beiträge zur Geschichte der Technik und Industrie*, 15, 262-75, 3 fig., 1925. ISIS

Horwitz, Hugo Th. Die Entwicklung der Drehbewegung. *Beiträge zur Geschichte der Technik und Industrie*, 10, 179-95, 13 fig., 1920. ISIS

Horwitz, Hugo Th. Technische Darstellungen in Bilderhandschriften des 13. bis 17. Jahrhunderts. *Beiträge zur Geschichte der Technik und Industrie*, 11, 179-184, 7 fig., 1921. ISIS

Hough, Walter. Collection of heating and lighting utensils in the United States National Museum. (*Smithsonian Institution, United*

States National Museum, Bulletin 141). VIII + 113 p., 99 pl. Washington, Government Printing Office, 1928. ISIS

This catalogue is magnificently illustrated by no less than 99 plates. It deals with torches, candles, and candlesticks, primitive lamps and others down to the gas lamps, heating devices. G. S.

Hough, Walter. Fire as an agent in human culture. XIV + 270 p. (*Smithsonian Institution, United States, National Museum*, Bull. 139) Washington, Government Printing Office, 1926. ISIS

Hulme, E. Wyndham. On the invention of English flint glass. *Transactions of the Newcomen Society*, 6, 75-85, 1926. ISIS

Jenkins, Rhys. Iron-making in the Forest of Dean. *Transactions of the Newcomen Society*, 6, 42-65, 1926. ISIS

Knowles, John A. The history of copper ruby glass. *Transactions of the Newcomen Society*, 6, 66-74, 1926. ISIS

Kammerer, (Prof.). Der Werkstoff im Kranbau. *Beiträge zur Geschichte der Technik und Industrie*, 14, 130-154, 34 fig., 1924. ISIS

Matschoss, Conrad. Technische Kulturdenkmäler. *Beiträge zur Geschichte der Technik und Industrie*, 17, 123-52, 92 fig., 1927. ISIS

Merz, Leopold. Die Geschichte des Feuerlöschwesens. *Beiträge zur Geschichte der Technik und Industrie*, 16, 162-82, 13 fig., 1926. ISIS

Moll, Friedrich. Holzschutz. Seine Entwicklung von der Urzeit bis zur Umwandlung des Handwerkes in Fabrikbetrieb. *Beiträge zur Geschichte der Technik und Industrie*, 10, 66-92, 1920. ISIS

Moll, Otto E. E., and Szymanski, H. Vorgeschichte des germanischen Schiffbaues. *Beiträge zur Geschichte der Technik und Industrie*, 11, 155-178, 22 fig., 1921. ISIS

Nasmith, Frank. Fathers of machine cotton manufacture. *Transactions of the Newcomen Society*, 6, 159-68, 1 fig., 1926. ISIS

Orth, Friedrich. Der Werdegang wichtiger Erfindungen auf dem Gebiete der Spinnerei und Weberei. *Beiträge zur Geschichte der Technik und Industrie*, 12, 61-108, 34 fig., 1922; 17, 89-105, 39 fig., 1927. ISIS

Peltzer, R. A. Geschichte der Aachen-Stolberger Messingindustrie.

Beiträge zur Geschichte der Technik und Industrie, 15, 196-209, 9 fig., 1925. ISIS

Pfeiffer, D. Die Schreibmaschine bis 1900. *Beiträge zur Geschichte der Technik und Industrie*, 14, 89-124, 30 fig., 1923. ISIS

Roe, Joseph Wickham. Aus der Geschichte der Amerikanischen Werkzeugmaschinen. *Beiträge zur Geschichte der Technik und Industrie*, 17, 106-116, 4 fig., 1927. ISIS

Two chapters translated from : English and American Tool-Builders, xv + 315 p. New York, McGRAW-HILL, 1926.

Rudd, W. R. The strangers in Norwich, a page in the history of our ancient textile industry. *Transactions of the Newcomen Society*, 6, 188-95, 1926. ISIS

Sommer, Fritz. Zur Geschichte der Solinger Klingen- und Waffenindustrie. Die Waffenfabriken Gebr. WEYERSBERG und CARL REINHARD KIRSCHBAUM in Solingen und ihr Einfluss auf die Herstellung von aufpflanzbaren Seitengewehren. *Beiträge zur Geschichte der Technik und Industrie*, 12, 109-123, 11 fig., 1922. ISIS

Turnbull, Alexander D. The STEVENS family, inventors and engineers. *Transactions of the Newcomen Society*, 6, 169-83, 1926. ISIS

IV. BIOLOGICAL SCIENCES

(Knowledge of organic nature).

27. — BIOLOGY

(Generalities, « Natural History »).

Cunningham, J. T. Modern biology. A review of the principal phenomena of animal life in relation to modern concepts and theories. XII + 244 p. London, KEGAN PAUL, 1928. ISIS

Daudin, Henry. Etudes d'histoire des sciences naturelles. I. De LINNÉ à JUSSIEU. Méthodes de la classification et idée de série en botanique et en zoologie (1740-1790). II + 264 p. II. CUVIER et LAMARCK. Les classes zoologiques et l'idée de série animale (1790-1830). XII + 460 + 338 p., Paris, ALCAN, 1926. ISIS

Reviewed by RAOUL M. MAY, *Isis*, 10, 502-5, 1928.

Donnan, F. G. The mystery of life. *Nature*, 122, 512-14, 1928. (See also editorial p. 501-03). ISIS

Fox, H. Munro. *Selene : or sex and the moon.* (Psyche miniatures, general series, no. 15.) 84 p. London, KEGAN PAUL, 1928. ISIS

Reviewed in *Nature*, 121, 981, 1928.

Franz, Victor. *Ontogenie und Phylogenie. Das sogenannte biogenetische Grundgesetz und die biometabolischen Modi. Abhandl. zur Theorie der organ. Entwicklung, Heft 3.* 51 S., Berlin, J. SPRINGER, 1927. ISIS

Reviewed by ZAUNICK, *Mitteilungen zur Geschichte der Medizin*, 27, 175, 1928.

Needham, Joseph. *Man a machine.* English edition : in the *Psyche Miniature series*, pp. 111, London, KEGAN PAUL, 1927 (2/6). American edition : in the *New Science series*, pp. 103 New York, W. W. NORTON, 1928 (\$1) ISIS

In 1927 Prof. EUGENIO RIGNANO published in the *Psyche Miniature series* an essay entitled « Man Not a Machine » in which he expounded his finalistic or general teleological views, applying them in particular to biology. Impressed by the fact that in 1748 JULIEN DE LA METTRIE had published his « Man a Machine » and that an anonymous reply to it had appeared in the following year entitled « Man More than a Machine, In Answer to a wicked and atheistical Treatise, written by M. DE LA METTRIE, and intitled Man, a Machine », the present writer determined to repeat the eighteenth century controversy by putting in a counter-plea to RIGNANO's from the standpoint of exact biology. He accordingly ventured to place the following words on his title-page — « Man a Machine, in answer to a romantical and unscientific treatise by Sig. EUGENIO RIGNANO ». The manner in which he attempted to substantiate this assertion may be roughly understood from the following headings :

(1) The teleological aspect of living beings not so evident and striking as some suppose. It is suggested that to an unbiassed mind without preconceptions or attachments to one side or the other, living organisms seem by no means overwhelmingly purposive, but in some cases thoroughly mechanical.

(2) The teleological aspect of living beings not by any means unique or characteristic of them as opposed to the rest of nature. In this section it is argued that as living beings cannot because of their constitution and structure be separated from the inorganic world, there is no case for restricting teleology to them, but on the contrary what purposiveness they show is but a department of universal teleology. These arguments largely follow the lines made familiar by Prof. LAWRENCE J. HENDERSON.

(3) The teleological aspect of living beings not susceptible of quantitative formulation and therefore not germane to science. Here teleology and mechanism are treated, after the Kantian manner, not as two entities in nature external to and independent of conceiving minds, but as aspects in the full sense of the word, and aspects which cannot be fused. It is argued that science is best regarded as the continual trend towards the numerical and the quantitative and that if this is so, teleology cannot be admitted unless it wears a quantitative wedding garment. So far no one has even sketched out such an article

of apparel and reasons are given for believing it to be an impossible task.

(4) Finally, some discussion is given of the methodological importance of mechanism in science and its inadequacy everywhere else. The picture of the universe which we obtain through scientific effort is far from being accurate and does not represent the universe as it really is, but philosophy, religion, and art, are equally in the dark, and it is only by a harmonious combination of them in human character that we can hope to correct the distortions of each. One thing, at any rate, is clear, namely, that science aims at describing the world in an equation, and therefore that the more quantitative a statement is the more it is scientific. Finalism, teleology, purposiveness, and with it Sig. RIGNANO, are thus relegated to the domain of philosophy where they are, no doubt, of great value, for FRANCIS BACON's notice to quit still holds good, and the writer sees no likelihood of its ever being withdrawn.

Apart from this main discussion the two first chapters are concerned with historical material concerning JULIEN DE LA METTRIE, his opinions and his writings.

J. N.

Needham, Joseph. Organicism in biology. Reprinted from the January number of *The Journal of philosophical Studies*, 3, 29-40, 1928. ISIS

« The word 'Organicism,' although it may seem unfamiliar to the younger generation of biologists, is not a new one, and has been heard of already in that shadowy limbo where philosophical and biological conceptions meet on common ground. The genius of its original minting is not known, but it figured largely in the great work of YVES DELAGE, the French zoologist, in which he attempted to survey and criticize every important biological theory which had ever been seriously produced. His *L'hérédité et les grands problèmes de la biologie* appeared in 1903, and in it he classified all biological theories, past, present, and future, under the four heads of 'Animism,' 'Evolutionism,' 'Micromerism,' and 'Organicism,' an arrangement which seems to us now more than a little illogical... »

...« It is our property to live in several worlds at once, and of these we know at least three : one, where everything can be analysed and abstracted into the form of equations, and where Man is a Machine; another where entities have an individuality which evaporates when they are dissected, and Man is an Organism; and a third where the notion of the 'General Course' can still be taken seriously, and Man is a child of God and an Inheritor of the City of Haeven. »

Needham, Joseph. Recent developments in the philosophy of biology. *The Quarterly Review of Biology*, 3, 77-91, 1928. ISIS

« There is indeed all the difference in the world between pushing mechanistic explanation as far as it will go with the realization that it will go all the way but will not entirely satisfy you when you have got there, and diluting it with other (qualitative) sorts of explanation, in the hope that the mixture will afford you full satisfaction. It is this latter process that is being given up in biology. Scientific explanation and philosophical explanation are two distinct foods of the soul, and they are confused only at great peril. »

28. — BOTANY.

(Agronomy, Phytopathology, Palaeobotany).

Horwitz, Hugo Th. Geschichte der Schokolade and Schokoladeindustrie. *Beiträge zur Geschichte der Technik und Industrie*, 13, 125-45, 1923. ISIS

Leclerc, Henri. Les légumes de France. Leur histoire, leurs usages alimentaires, leurs vertus thérapeutiques. 217 p. Paris, MASSON, 1928. ISIS

Reviewed by LAIGNEL-LAVASTINE, *Bulletin de la société française d'histoire de la médecine*, 22, 221-22, 1928.

Lindley Library: catalogue of books, pamphlets, manuscripts, and drawings. VIII+488 p. London, Royal Horticultural Society, 1927. ISIS

Peters, Hermann (d. 1920). Aus der Geschichte der Pflanzenwelt in Wort und Bild. Hrg. von der Gesellschaft für Geschichte der Pharmazie. 176 S. Mittenwald in Oberbayern, ARTHUR NEMAYER, 1928. ISIS

Posthumous publication, with a preface by GEORG URDANG, the congenial author of « Der Apotheker im Spiegel der Literatur » etc. There are thirty chapters including one each on saffron, mandrake, poppy, olive, cypress, etc. This publication is a desirable supplement to « Aus pharmaceutischer Vorzeit » and will be welcomed by all lovers of the Scientia amabilis, whether they be botanists, pharmacists, physicians, or merely lovers of nature and literature. E. K.

Porteous, Alexander. Forest folklore, mythology, and romance. 319 p. London, ALLEN and UNWIN, 1928. ISIS

Forests of Eld; fabulous forests; forestry; groves; mythical denizens of the forests and woods; trees; folklore, legendary.

Rübel, Eduard. The present state of geobotanical research in Switzerland. *Beiblatt zu den Veröffentlichungen des Geobotanischen Instituts Rübel in Zürich*, No. 4, 46 p. Bern, HANS HUBER, 1928. ISIS

Contains a brief historical sketch of Swiss phytosociological research. Paper read at Ithaca, N. Y., in 1926.

Singer, Charles. The herbal in antiquity. *Journal of Hellenic Studies*, 47, 52 p., 10 colored plates and 46 fig. London, 1927. ISIS

Reviewed by G. S., *Isis*, 10, 519-21, 1928.

29. — ZOOLOGY.

Digby, Bassett. The mammoth and mammoth-hunting in northeast Siberia. 224 p., photographs, map. London, WITHERBY, 1926. ISIS

This is an account of the finds of fossil ivory and of mammoths in Siberia together with the author's personal experiences in the course of a similar quest. The first tidings of Siberian mammoths were brought to England in 1611, by JOSIAS LOGAN. The first flesh-and-blood mammoth found by a man of science was the one discovered on the tundra, near the mouth of the Lena, by the Russian naturalist ADAMS in 1805. Others have been found since, but not at all as many as most people imagine. The author has compiled a list of twenty mammoths and four woolly rhinoceros discovered between 1707 and 1912, and a map giving the locations of these finds. « No mammoth in the flesh, and very few bones, has been found within a couple of thousand miles of the railway zone. The finds are made chiefly in the New Siberian isles, and within a hundred miles or so of the Arctic seashore. » There is no doubt that the New Siberian isles were once part of the continent; they contain large quantities of fossil bones and ivory. It is a pity that this book is so badly written, in a journalistic style, without references. Incidentally, I found in it additional information on the legend that elephants have no joints in their legs, legend dealt with by Col. STEPHENSON in a recent number (*Isis*, 11, 298). Sir THOMAS BROWNE repeated it in his *Pseudodoxia epidemica* (1646), and even SHAKESPEARE referred to it in *Troilus and Cressida*.

G. S.

Forel, Auguste. The social world of the ants compared with that of man. Translated by C. K. OGDEN. Vol. 1., XLV + 551 p., 10 pl. Vol. 2., XX + 445 p., 16 pl. London, G. P. PUTNAM'S Sons, 1928. ISIS

Reviewed by J. S. HUXLEY, *Nature*, 121, 819-22, 1928.

Gudger, E. W. Live fishes impacted in the pharynx of man. An addendum. *Archives of Pathology and Laboratory Medicine*, 4, 346-55, September, 1927. ISIS

Gudger, E. W. Fishing with the otter. *The American Naturalist*, 61, 193-225, 1927. ISIS

Otter-fishing in China, Malaya, India, Sweden, Poland, Switzerland, France and Germany, England, Scotland, America. In all the countries where the otter is or has been extensively used as a fisherman, « it has been used in two ways — to catch the individual fish and bring it to its master or to drive the fishes into the net. These two uses parallel those for dogs, as shown by the present writer in another paper. » A final chapter explains how the otter is trained.

G. S.

Gudger, E. W. and Breder, C. M., Jr. The barracuda (*sphyræna*) dangerous to man. Reprinted from *The Journal of the American Medical Association*, 90, p. 1938-1943, 5 fig., Chicago, 1928. ISIS

- Moodie, Roy L. Studies in paleopathology, XXII. Pyorrhea in a Pleistocene wolf. *Annals of medical history*, 10, 199-201, 2 fig., 1928.

ISIS

- Regnier, Robert. Matériaux pour l'organisation d'une exposition de zoologie agricole et d'entomologie appliquée. L'exposition zoologique et florale du Jardin des plantes de Rouen (19-23 Juin, 1924). (Avec la collaboration de R. PUSSARD et E. LE GRAVEREND). *Bulletin de la Société des amis des sciences naturelles de Rouen*, 223-60, 1924-25.

ISIS

- Vosmaer, G. C. J. (1854-1916). Bibliography of sponges, 1551-1913. Edited by G. P. BIDDER, and C. S. VOSMAER-RÖELL. XII + 234 p. Cambridge University Press, 1928.

ISIS

« GUALTHERUS CAREL JACOB VOSMAER, eldest son of CAREL VOSMAER (the poet and author of the great monograph on REMBRANDT), was born on August 29th, 1854, in Nieuw-Beijerland, Netherlands. He entered the University of Leiden in 1873 and studied sponges with F. E. SCHULZE in Graz in 1879-1880, and in the latter year took his doctor's degree at Leiden. Of his doctoral dissertation it is not too much to say that no one ever writes of the canal-system of sponges, and rarely does anyone describe the anatomy of a sponge, without alluding consciously or unconsciously to VOSMAER's *Leucandra Aspera*. In 1882 he was appointed a zoologist on the staff of the Zoological Station at Naples, where he laid the foundation for his magnum opus, the monograph for the Fauna und Flora of the Zoological Station, and in 1882 he published the first part of the volume on sponges in BRONN's Klassen und Ordnungen, completed in 1886. In 1900 he was made a member of the Royal Academy of Science in Amsterdam, and Professor of Zoology in the University of Leiden in 1903; and there he died in September, 1916. The present bibliography of literature dealing with sponges he began in 1880 and was revising in 1916. It has been completed and edited by his widow, Madame VOSMAER-RÖELL, and Dr. G. P. BIDDER. »

- Zimmer, John Todd. Catalogue of the EDWARD E. AYER ornithological library. 2 vols. x + 706 p., 12 pl. Chicago, Field Museum of Natural History, 1926.

ISIS

Reviewed by GEORGE SARTON, *Isis*, 10, 94, 1928.

V. SCIENCES OF THE EARTH

(implying knowledge of both organic and inorganic nature).

. 31. — GEOGRAPHY AND OCEANOGRAPHY.

- Febvre, Lucien. L'école géographique française et son effort de synthèse. *Revue de Synthèse Historique*, 45, 26-41, 1928.

ISIS

- Heawood, E. The island of San Matteo. *Nature*, 122, 440, 1928.

ISIS

- Shand, S. J. The island of San Matteo. *Nature*, 122, 440, 1928.

ISIS

32. — GEOLOGY, MINERALOGY, PALAEONTOLOGY, MINING.

(For palaeobotany, palaeozoology and palaeoanthropology, see respectively 28. botany, 29. zoology and 39. prehistory.)

Chamberlin, Thomas Chrowder (1843-1928). The growth of the earth. 23 p., 4 fig. Reprint from *Scientia*, Sept. 1927. ISIS

Grunewald und Eichenberg. Urkundliche. Beiträge zur Geschichte des rheinischen Braunkohlenbergbaues. *Beiträge zur Geschichte der Technik und Industrie*, 15, 126-147, 16 fig., 1925. ISIS

Hawkes, Arthur J. Jubilee exhibition of early mining literature, Wigan public libraries. May 1 to September 29, 1928. Annotated catalogue compiled and arranged, with an introduction. Foreword by the Earl of CRAWFORD AND BALCARRES. XIV + 38 p. Wigan, Public Library, 1928. ISIS

Illies (Oberingenieur). Aus der geschichtlichen Entwicklung des Eisenhüttenwesens Oberschlesiens anhand der Geschichte der Königshütte. *Beiträge zur Geschichte der Technik und Industrie*, 12, 1-39, 27 fig., 1922. ISIS

Landes, Henry. History of geology in the state of Washington. *The Washington Historical Quarterly*, 19, 243-49, 1928. ISIS

Orth, Friedrich. Die prähistorische Kupfergewinnung und ihre Darstellung im « Deutschen Museum ». *Beiträge zur Geschichte der Technik und Industrie*, 11, 216-28, 18 fig., 1921. ISIS

Pieper, Wilh. Die Entwicklung des Kohlenbergbaus im Gebiet um Halle bis zum Bau der Eisenbahnen. *Beiträge zur Geschichte der Technik und Industrie*, 16, 133-52, 1926. ISIS

Sparr, Enrique. La diferenciación de las ciencias geológicas de acuerdo con el título de suas revistas. *Boletín de la Academie Nacional de Ciencias*, Cordoba, 30, 341-347. Buenos Aires, 1927. ISIS

Reviewed by ZAUNICK, *Mitteilungen zur Geschichte der Medizin*, 27, 165, 1928.

Sudbury, Louise. What is the first fossil collected by man? *Science*, 68, 135, 1928. ISIS

The *Cycadeoidea etrusca* in the Capellini Museum, Bologna.

Treptow, E. Bergmännische Kunst. *Beiträge zur Geschichte der Technik und Industrie*, 12, 173-212, 41 fig., 1922. ISIS

(Wegener, Alfred). Theory of continental drift : a symposium on the origin and movement of land masses, both intercontinental and intra-continental, as proposed by ALFRED WEGENER. By W. A. J. M. VAN WATERSCHOOT VAN DER GRACHT, BAILEY WILLIS, ROLLIN T. CHAMBERLIN, JOHN JOLY, G. A. F. MOLENGRAAFF, J. W. GREGORY, ALFRED WEGENER, CHARLES SCHUCHERT, CHESTER R. LONGWELL, FRANK BURSLEY TAYLOR, WILLIAM BOWIE, DAVID WHITE, JOSEPH T. SINGEWALD, Jr., and EDWARD W. BERRY. x + 240 p. Tulsa, Oklahoma, The American Association of Petroleum Geologists, 1928.

ISIS

Reviewed by ARTHUR HOLMES, *Nature*, 122, 431-33, 1928.

33. — METEOROLOGY, CLIMATOLOGY, AND TERRESTRIAL PHYSICS.

Shaw, Sir Napier, with the assistance of ELAINE AUSTIN. Manual of Meteorology, Vol. II. Comparative Meteorology. xl + 466 p., 225 ill. Cambridge University Press, 1928.

ISIS

Reviewed by ALEXANDER MCADIE, *Science*, vol. 67, 632, 1928, and by V. BJERKNES, *Nature*, 121, 931-32, 1928.

Tallqvist, Knut. Himmelsgegenden und Winde. *Studia Orientalia* • editit Societas Orientalis Fennica. 2, 105-185, Helsingfors, 1928.

ISIS

Very elaborate study on the names of celestial directions and winds in a great many languages. Main divisions : Einleitende Betrachtungen ; Die lokal-geographische Orientierung : Wasserseite, Seewind Landseite, niederes Land, Hochland. Nach Bergen, Flüssen, Ländern und Ortschaften bennante Richtungen ; Die Qibla-Orientierung ; Die Solare orientierung ; Die polare Orientierung ; Die Zwischenrichtungen ; Nachträge ; Wörterverzeichnis.

VI. ANTHROPOLOGICAL AND HISTORICAL SCIENCES

(Knowledge of man, past and present).

34. — ANATOMY.

Ramón y Cajal, Santiago. Degeneration and regeneration of the nervous system. Translated and edited by RAOUL M. MAY. 2 vols. illúst. Oxford University Press, London, MILFORD, 1928. (50 s.)

ISIS

An analysis of the original edition of this fundamental work, *Estudios sobre la degeneración y regeneración del sistema nervioso* (Madrid, 1913-14), was published in *Isis*, 7, 280-81. That original edition was distributed mainly to South American subscribers. It is not too much to say that it was practically unknown in Europe and North America. Moreover the author has taken

advantage of this translation to improve his text and to add to it a number of notes representing the result of eight years of continuous and patient study. MAY's excellent translation of one of the classics of modern anatomy is thus at the same time a new edition of it. It is splendidly published by the Oxford Press and contains a fine portrait of the author. For a sketch of the latter's life and personality, see R. M. MAY in *Isis*, 8, 498-503. It is worthwhile recalling that the first chapter of Degeneration (vol. 1, 3-26) is devoted to the history of the subject from the time of AUGUSTUS VOLNEY WALLER (1850, 1852), down to RAMÓN's own time. The author pays homage to WALLER, whose intuitions were truly prophetic. In spite of the fact that histological technique was utterly insufficient in WALLER's days, he was able to formulate the true solution of the problem «Paradoxical as it may appear, it is certain that in the problem with which we are dealing, contrary to the usual course of science, error is modern while truth is ancient.» G. S.

Singer, Charles. The evolution of anatomy. A short history of anatomical and physiological discovery to HARVEY. Being the substance of the Fitzpatrick Lectures delivered at The Royal College of Physicians of London in the years 1923 and 1924. London, KEGAN PAUL; XII + 209 p., 22 pl., 117 fig. New York, KNOPF, 1925. *ISIS*

Reviewed by CHAUNCEY D. LEAKE, *Isis*, 10, 521-24, 1928.

35. — PHYSICAL ANTHROPOLOGY.

(*Anthropometry and races of man*)

Andersson, T. och Thordemann, B. VALDEMAR ATTERDAGS Tåg mod Gotland 1361 och Krigergravarna vid Korsbetningen. Två Studior. 49 p. K. Vitterhets-Historie-och Antikvitetsakademiens Förlag. (German summary.) Stockholm, 1927. *ISIS*

See note on E. CLASON, below.

J. W. S. J.

Clason, E. Om i Korsbetningsgraven vid Visby funna skelett. Kgl. Vitterhets Akademiens Handlingar, XXVIII, 1925. *ISIS*

Before King VALDEMAR ATTERDAG conquered Visby in Gotland, Sweden, his army was engaged in a very bloody battle with the peasants of the island, who had raised themselves against the foreign intruder. All those who fell were buried on the battlefield itself and the spot was marked with a stone cross bearing an inscription and the exact date 7-7-1361. Recent excavations have shown that the corpses were thrown pêle-mêle into the graves, mere holes dug out in the earth, each containing hundreds of dead men, lying in their war-hoods, and we are thus in possession of a series of skeletons, exactly dated which constitute excellent material for an anthropological examination. CLASON's investigations have shown, that the peasant army was made up of quite young and of a great many old men, of which many were invalids, suffering from arthritical diseases, malformations after fractures, etc., which shows that only the youngsters and the old men were left, when the invasion took place

J. W. S. J.

- Osborn, Henry Fairfield. Man rises to Parnassus. Critical epochs in the prehistory of man. (Second edition.) XIX + 251 p. Princeton, Princeton University Press, 1928. ISIS

36. — PHYSIOLOGY

(human and comparative).

- Fulton, J. F. Muscular contraction and the reflex control of movement. xv + 644 p., 204 + 11 fig., Baltimore, WILLIAMS and WILKINS, 1926. ISIS

Elaborate historical introduction, p. 3-55, with chronological bibliography and many illustrations. G. S.

- Irsay, Stephen d'. Der philosophische Hintergrund der Nervenphysiologie im 17. u. 18. Jahrhundert. *Archiv für Geschichte der Medizin*, 20, 181-97, 1928. ISIS

37. — PSYCHOLOGY

(human and comparative).

- Blondel, Charles. Introduction à la psychologie collective. (Collection Armand Colin). 211 p. Paris, COLIN, 1928 (frs. 9). ISIS

Contents : Première partie. La psychologie selon COMTE, DURKHEIM et TARDE; Deuxième partie : 1. La perception; 2. La mémoire; 3. La vie affective. Conclusion. Bibliographie.

40. — ETHNOLOGY.

(Primitive and popular science).

- Alvarez, Walter C. Dr. NICOLAS LEON (1859-). *Annals of Medical History*, 10, 316-18, 1928. ISIS

- Gudger, E. W. Wooden hooks used for catching sharks and *Ruvettus* in the south seas; a study of their variation and distribution. *Anthropological papers of the American Museum of Natural History*, 28, part 3, p. 199-348, 92 fig., New York, 1928. ISIS

"There is one type of *Ruvettus* hook widely distributed in the Pacific, the local variations consisting of inessentials. So *Ruvettus* fishing, as a culture trait complex, is common to all of the three main culture areas (insular) in the Pacific. The ethnographical significance of this is that the technique of *Ruvettus* fishing has been distributed over the whole insular area in the Pacific and, since the distribution is continuous, presumably from a single center. Such examples of wide diffusion for a highly specialized trait are far from numerous, which enhances the importance of this contribution."

CLARK WISSLER.

Harcourt, Raoul et Marg. Béclard d'. La musique des Incas et ses survivances, vol. 1, Texte, 8-576 p.; vol. 2, 23 p., 39 pl. Paris, GEUTHNER, 1925. ISIS

Reviewed by R. C. ARCHIBALD, *Isis*, 10, 524-6, 1928.

Hoffmann-Krayer, E. Volkskundliche Bibliographie für die Jahre 1921 und 1922. Im Auftrage des Verbandes Deutscher Vereine für Volkskunde herausgegeben. xxvii + 414 p. Berlin, WALTER DE GRUYTER, 1927. ISIS

Horwitz, Hugo Th. Beiträge zur aussereuropäischen Technik. *Beiträge zur Geschichte der Technik und Industrie*, 11, 185-196, 16 fig., 1921; 16, 290-98, 1 fig., 1926. ISIS

Horwitz, Hugo Th. Ueber die Konstruktion von Fallen und Selbstschüssen. *Beiträge zur Geschichte der Technik und Industrie*, 14, 85-100, 21 fig., 1924. ISIS

Horwitz, Hugo Th. Der Streit über die Tipiti-Pressen. *Beiträge zur Geschichte der Technik und Industrie*, 17, 159-61, 1 fig., 1927. ISIS

Horwitz, Hugo Th. Ueber eine Urform von Lager- und Scharnierkonstruktionen. *Beiträge zur Geschichte der Technik und Industrie*, 17, 162-3, 3 fig., 1927. ISIS

Reichborn-Kjennerud, J. Vår gamle Trolldomsmedisin. I. (*Skrifter utgitt av Det Norske Videnskaps-Akademi i Oslo*, II. *Hist.-Filos. Klasse*. 1927. No. 6. 284 p. Oslo, JACOB DYBVAD, 1928.) ISIS

Out of the Sagas the author has compiled every possible note concerning animism, demonology, popular medical treatment, medical superstition and folklore. This enormous material is compared with the medical folklore of our days and with that of the classic authors. Though the old Scandinavian medicine has been treated by a great many other authors, and the literature about it is very considerable this work is the first real handbook on the subject. The notes fill not less than 46 pages printed in two columns. A bibliography (12 pages) and a very large index of special terms are added to this excellent work. May the two following parts soon appear. J. W. S. J.

Smith, G. Elliot; Malinowski, Bronislaw; Spinden, Herbert J.; Goldenweiser, A. Culture: the diffusion controversy. (*Psyche miniatures, general series*, no. 18.) 98 p. London, KEGAN PAUL, 1928. ISIS

Tassmann, Günter. Ein Beitrag zur eisenhüttentechnischen Entwicklung der Naturvölker Kameruns. Eisenhütten- und Schmiede-

wesen der Baja. *Beiträge zur Geschichte der Technik und Industrie*, 11, 95-116, 22 fig., 1921. ISIS

Wright, Jonathan (1860-1928). Medicine of primitive man. *Medical life*, vol. 34, 514-18, 1927; vol. 35, 366-72, 1928. ISIS

41. — SUPERSTITION AND OCCULTISM.

Bächtold-Stäubli, Hanns. Handwörterbuch des deutschen Aberglaubens. Herausgegeben unter besonderer Mitarbeit von E. HOFFMANN-KRAYER und Mitwirkung zahlreicher Fachgenossen. Bd. I. Lieferung 1. Berlin, WALTER DE GRUYTER, 1927. ISIS

Dacqué, Edgar. Natur und Seele. Ein Beitrag zur magischen Weltlehre. 200 S., 1 Bl. Inhalt. München, R. OLDENBOURG, 1926. ISIS
Reviewed by Graf CARL V. KLINCKOWSTROEM, *Isis*, 10, 95-8, 1928.

Edgell, William. Does the earth rotate? Reprint. 69 p. Radstock, Somerset, The author, Westfield House, 1927. ISIS
Reviewed by A. C. D. C., *Nature*, 121, 981, 1928.

Jollivet, Castelot. Chimie et alchimie. 288 p. Paris, E. NOURRY, 1928.

Jollivet, Castelot. La fabrication chimique de l'or. Texte français (traductions anglaise, allemande, espagnole). 126 p. JOLLIVET CASTELOT Douai, 19 Rue Saint-Jean, 1928. ISIS
Reviewed by A. A. E., *Nature*, 121, 981, 1928.

Krause, Arthur. Die Astrologie. Entwicklung, Aufbau und Kritik. VII + 319 p., 50 fig. Leipzig, J. J. WEBER, 1927. ISIS
Reviewed by W. GUNDEL, *Deutsche Literaturzeitung*, 783-4, 1928.

Maxwell, Joseph. La divination. 84 p. Paris, *Biblioth. de philos. scientif.*, E. FLAMMARION, 1927. ISIS

J'ai précédemment signalé (*Isis*, 6, 121), un livre consacré par l'auteur à la magie. L'ouvrage qu'il vient de publier dans la même collection fait directement suite au précédent. Il y étudie sommairement tous les procédés divinatoires dans leur évolution historique (106 p.), les procédés usuels dans la société contemporaine (95 p.), leur mécanisme psychologique qui dépend de l'intuition considérée comme une faculté de la conscience organique (subconscient) qui trouve sa base dans la sensibilité, et qui correspond à un être continu (réincarnation). L. G.

43. — SOCIOLOGY, JURISPRUDENCE AND POSITIVE POLITY.

Bouvier, Robert. La notion de loi. Esquisse historique et remarques générales. *Revue de Synthèse Historique*, 45, 5-26, 1928. ISIS

43.SOCIOLOGY. 44.HISTORY OF CIVILIZATION. 45.HISTORY OF ART 433

Fisher, H. A. L. PAUL VINOGRADOFF, a memoir. Oxford, Clarendon Press, 1927. ISIS

Reviewed by N. NEILSON, *Speculum*, 3, 107-9, 1928.

Guénon, René. La crise du monde moderne. 248 p., BOSSARD, Paris, 1927. ISIS

On va partout parlant du malaise de la société du XXe S., de crise latente, de révolution qui couve. Pour GUÉNON, notre monde occidental est entré en crise, en décadence, au début du XVIe siècle; l'humanisme de la Renaissance a précipité la chute qui ne fait que s'accroître, et que rien ne pourrait plus arrêter, sinon un retour à la « tradition », à la « contemplation », mis en œuvre par une élite qui pourrait s'appuyer sur l'église catholique à condition que celle-ci se dépouillât de tout ce qui n'est pas conforme à la tradition profonde de la doctrine hindoue, telle du moins que l'entend l'auteur (Voir pour 2 autres ouvrages de GUÉNON, de même inspiration, *Isis*, 8, 591-642). L. G.

Pipkin, Charles W. The idea of social justice : a study of legislation and administration and of the labour movement in England and France between 1900 and 1926. xvi + 595 p. New York, MACMILLAN, 1927. ISIS

Reviewed by AMY HEWES, *American Historical Review*, 34, 130-32, 1928.

44. — HISTORY OF CIVILIZATION

(General History, Historical methods, Biography and Chronology.)

Revue Historique. Histoire et historiens depuis cinquante ans. (*Bibliothèque de la Revue Historique.*) Two volumes. p. XII, 1-472, 473-758, Paris, ALCAN, 1927. ISIS

Collection of essays to celebrate the golden jubilee of the *Revue historique*. Reviewed by J. F. JAMESON, *American Historical Review*, 34, 92-3, 1928.

45. — HISTORY OF ART.

(Art and science, Iconography. Arts and crafts).

Blum, André. Les sources iconographiques et leur enseignement; leur valeur artistique et historique. *Bulletin of the international committee of historical sciences*, 1, 736-46, 1928. ISIS

Depréaux, Albert. L'iconographie, science auxiliaire de l'histoire. *Bulletin of the international committee of historical sciences*, 1, 725-35, 1928. ISIS

Guastalla, Pierre. L'esthétique et l'art. 205 p. VRIN, Paris, 1928. ISIS

Cet ouvrage nous apporte des discussions intéressantes et originales sur un certain nombre de questions généralement mal posées, ou posées d'une manière trop vague : notamment sur l'introduction de la notion de valeur en esthétique, sur les caractères comparés de l'artiste et de l'amateur d'art, sur le rôle de l'habitude et du rêve dans l'élaboration de l'inspiration artistique, sur l'esthétique spéciale à chaque art. M. GUASTALLA qui est à la fois un savant et un artiste (*Isis*, 9, 207) n'apporte sans doute pas la solution définitive à ces problèmes qui sont en marge des domaines de la science et de l'art ; mais il aidera son lecteur à voir plus clair en sa propre pensée, ce qui est déjà un grand mérite.

H. M.

Klein, Walter. Geschichte der Gmünder Edelmetallindustrie. *Beiträge zur Geschichte der Technik und Industrie*, 17, 72-79, 14 fig., 1927.

48. — HISTORY OF PHILOSOPHY.

(See also above 18. *Philosophy of Science*).

Brunschvicg, Léon. Le progrès de la conscience dans la philosophie occidentale. Deux vols. (*Bibliothèque de philosophie contemporaine*), XXIII + 807 p. Paris, ALCAN, 1927. ISIS

Reviewed by HÉLÈNE METZGER, *Isis*, 10, 98-102, 1928.

49. — HISTORY OF RELIGION.

(*Science and Religion*).

Archambault, Paul, et autres. La renaissance religieuse. Introduction et conclusion par GEORGES GUY-GRAND. 273 p. (*Bibl. de philos. contemp.*) Paris, ALCAN, 1928. ISIS

Enquête menée en France seulement (ce que devrait indiquer le titre de l'ouvrage), par GEORGES GUY-GRAND et à laquelle ont apporté leur témoignage, des représentants du catholicisme : R. P. YVES DE LA BRIÈRE, GAETAN BERNVILLE, PAUL ARCHAMBAULT, R. P. JOSEPH DE TONQUÉDEC, JACQUES CHEVALIER ; du protestantisme : A. N. BERTRAND, RENÉ GILLOUIN ; du judaïsme : JULIEN WEILL, ANDRÉ SPIRE ; du rationalisme laïque : RAMON FERNANDEZ, PAUL LOUIS COUCHOUD, FÉLIX SARTIAUX, FÉLICIE CHALLAYE, PAUL MASSON-OURSSEL, LÉON BRUNSCHVICG ; ces trois derniers étudiant les rapports de l'Orient et de l'Occident.

L. G.

Delehaye, H. Les légendes hagiographiques. Troisième édition, revue et complétée. xv + 226 p. Bruxelles, Société des Bollandistes, 1927. ISIS

Reviewed by PAUL MONCEAUX, *Journal des Savants*, 368-69, 1928.

Delehaye, H. Sanctus. Essai sur le culte des saints dans l'antiquité. VIII + 266 p. Bruxelles, Société des Bollandistes, 1927. ISIS

Reviewed by PAUL MONCEAUX, *Journal des Savants*, 368-69, 1928.

Lodge, Sir Oliver. Why I believe in personal immortality. VIII + 152 p., 4 pl. London, CASSELL, 1928. ISIS

Reviewed in *Nature*, 121, 278-279, 1928.

Singer, Charles. Religion and science. Considered in their historical relations. (*Benn's Sixpenny Library*, no. 144). 79 p. London, ERNEST BENN, 1928. ISIS

A very good account, well thought out and well written, of this old, eternal, problem. If all the volumes of Benn's Sixpenny Library, edited by WILLIAM ROSE, are as good as this one, this new library is a real blessing. G. S.

Söderblom, Nathan. Das Werden des Gottesglaubens. Untersuchung über die Anfänge der Religion. Deutsch hrsg. von R. STÜBE. 2. neubearb. Auflage. xv + 361 p. Leipzig, J. C. HINRICHS, 1926.

Reviewed by FRIEDRICH HEILER, *Deutsche Literaturzeitung*, 1049-1052, 1928.

VII. MEDICINE.

50. — HISTORY, ORGANIZATION, AND PHILOSOPHY OF MEDICINE.

Andrews, Edmund. Medical terminology. *Annals of medical history*, 10, 180-198, 1928. ISIS

Discussing the origin of many medical terms.

Brunn, Walter von. Kurze Geschichte der Chirurgie. iv + 339 p. Berlin, JUL. SPRINGER, 1928. ISIS

Reviewed by ERNST HIRSCHFELD, *Deutsche Literaturzeitung*, 1128-1130, 1928.

Delaunay, Paul. L'évolution philosophique et médicale du bio-mécanisme : De DESCARTES à BOERHAAVE, de LEIBNIZ à CABANIS. *Le Progrès Medical*, 20, tiré à part, 55 p., 1927. ISIS

Delaunay, Paul. L'évolution médicale du XVI^e au XX^e Siècle, *Bulletin de la Société française d'histoire de la médecine*, 22, 17-56. 1928. ISIS

Györy, Tiberius von. Der Anteil Ungarns an der Entwicklung der Medizin. S. A. a.d. Pester Lloyd vom 27. 5. 1928. 29 S. Budapest, 1928. ISIS

Reviewed by HABERLING, *Mitteilungen zur Geschichte der Medizin und der Naturwissenschaften*, 27, 329, 1928.

Haberling, Wilhelm. Woran erkennt man auf Bildnissen den Arzt? *Therapeutische Berichte*, 1928, nos. 2 to 10. ISIS

Rich collection of illustrations with commentary. Physicians are represented

as disciples of Asclepius; with cupping glass and urinal; with patient; with human skull; with herbs; with chemical apparatus; with physical apparatus; with their own books; etc. Thus a collection of portraits tells us the whole history of medicine. G. S.

Kelly, Howard A. and Burrage, Walter L. Dictionary of American medical biography. Lives of eminent physicians of the United States and Canada, from the earliest times. Boston, APPLETON, 1928. ISIS

Lenghel, Alexandre. Anciens pessaires trouvés en Hongrie et en Transylvanie. *Bulletin de la société française d'histoire de la médecine*, 22, 185-88, 1928. ISIS

Long, Esmond R. A history of pathology. xxiv + 291 p., 49 pl. Baltimore, WILLIAMS and WILKINS, 1928. (Five dollars) ISIS

As far as I know this is the earliest history of pathology to appear in book form, though a part of the field was covered by KNUD FABER in his *Nosography in modern internal medicine* (in Danish, Copenhagen 1919; English translation, New York, 1923; *Isis*, 6, 98-99). FABER began his account with SYDENHAM. EDGARD GOLDSCHMID's *Entwicklung und Bibliographie der pathologisch-anatomischen Abbildung* (Leipzig, 1925; *Isis*, 8, 817) is something different again, — an historical iconography of pathology. LONG has written his book for medical students, who are primarily interested in the history of medicine *stricto sensu*, and, I am sure, they will find his account very stimulating. It is richly illustrated; 49 plates and other figures, reproducing portraits and pathological illustrations taken from the classics. (But what is the good of reproducing imaginary portraits of CELSUS and GALEN?)

The subject is divided as follows: 1. Pathology of antiquity; 2. GALEN and the Middle Ages; 3. Pathology of the Renaissance; 4. Seventeenth century; 5. MORGAGNI and the eighteenth century; 6. The Paris School at the opening of the nineteenth century; 7. Pathology in England in the first half of the nineteenth century; 8. ROKITANSKY and the new Vienna School; 9. VIRCHOW and the cellular pathology; 10. Pathological histology and the last third of the nineteenth century; 11. Rise of bacteriology and immunology; 12. Experimental and chemical pathology.

To illustrate how much such a history differs from the general history of medicine, it will suffice to consider the outstanding names (apart from the greater masters): BENIVIENTI, FERNEL, PLATTER, COITER, DODOENS, SCHENCK VON GRAFENBURG, SEVERINO, TULP, PIETER PAUW, WEPFER, BONET, KERKRING, BLANKAART, VIEUSSSENS, SENAC, SANDIFORT, GAUB, BAILLIE, BAYLE, LOBSTEIN, CRUVEILHIER, RAYER, CARSWELL, HORNER, VETTER, WEICHSELBAUM, PALTAUF, CHIAPI, PANUM, RECKLINGHAUSEN, VILLEMEN, STRICKER, WEIGERT, ZIEGLER, ZENKER, PAGET, DELAFIELD, PRUDDEN. G. S.

Meige, Henri. Les urologues dans l'art. *Aesculape*, 54-67, 14 illustr., mars 1928.

Näsström, Gustaf. Det gamle Medevi. 286 p., 76 fig. Stockholm, NILS BRUZELIUS, 1928.

Medevi, the Karlsbad of Sweden, is followed from its origin as a holy spring unto our days. The book, privately printed by the apothecary NILS BRUZELIUS, gives a very good description of the evolution of the thermal place from its foundation as a sanitary institution by URBAN HJÄRNE in 1675. Splendid illustrations. J. W. S. J.

Singer, Charles. A short history of medicine : Introducing medical principles to students and non-medical readers. xxiv + 368 p. Oxford, Clarendon Press, 1928. ISIS

Szumowski, W. La médecine polonaise à travers les siècles. *Paris Médical*, 12^e année, I-VI, 13 mai 1922. ISIS

Temkin, Owsei. Die Krankheitsauffassung von HIPPOKRATES und SYDENHAM in ihren :« Epidemien ». *Archiv für Geschichte der Medizin*, 20, 327-52, 1928. ISIS

Wright, Jonathan (1860-1928). Bibliography of his writings, with biography and portrait. *Medical life*, 35, 358-366, 1928. ISIS

51. — EPIDEMIOLOGY, HISTORY OF SPECIAL DISEASES. PUBLIC HEALTH AND SOCIAL MEDICINE.

Hansen, Aksel. Om Chlorosens, den ægte Blegtsots, Optraeden i Europa gennem Tiderne. xxviii + 202 p., xviii, 29 fig. Schäffer, KOLDING, 1928. ISIS

A very elaborate study on the genuine chlorosis and its relation to the use of corsets and stays. Unknown in antiquity, the disease follows the modes, appears when corsets are in use and disappears when they are out of fashion. The disease is restricted to the female sex. Discussion of the different theories about its origin. J. W. S. J.

Meyerhof, Max. Nachträge zur Geschichte des Begriffes Pannus. *Archiv für Geschichte der Medizin*, 20, 390-96, 1928. ISIS

52. — HISTORY OF HOSPITALS AND OF MEDICAL TEACHING.

Andel, M. A. van. Vroedvrouwenbordjes. *Bijdragen tot de geschiedenis der geneeskunde*, 8, 149-153, 3 fig., 1928. ISIS

Giedroyc, F. Le service de santé dans l'ancienne Armée polonaise. (Sluzba zdrowiaw dawnem Wojsku polskiem). Varsovie, 1927. ISIS

Reviewed by V. BUGIEL, *Bulletin de la Société française d'histoire de a médecine*, 22, 84-5, 1928.

ellinga, G. De voormalige Amsterdamsche clinische school en het

Binnengasthuis, 1828 — 1 September — 1867. *Bijdragen tot de geschiedenis der geneeskunde*, 8, 230-79, 1928. ISIS

Schevensteen, A. van. Les chirurgiens de l'hôpital Sainte-Elisabeth à Anvers, jusqu'à la fin de l'Ancien Régime. *Recueil des mémoires couronnés et autres mémoires de l'Académie royale de médecine de Belgique*, 23, 46 p., Bruxelles, Imprimerie l'Avenir, 1927.

Sieur (Médecin inspecteur général). Histoire des tribulations du corps de santé militaire depuis sa création jusqu'à nos jours. *Bulletin de la Société française d'histoire de la médecine*, 22, 92-163, 1928. ISIS

53. — PHARMACY. PHARMACOLOGY. TOXICOLOGY.

Andel, M. A. van. Klassieke Wondermiddelen. XI. Bezoarsteenen; XII. Terra sigillata. *Bijdragen tot de geschiedenis der geneeskunde*, 8, 197-215, 1928. ISIS

Cripps, Ernest C. Plough Court, the story of a notable pharmacy, 1715-1927. XVIII + 227 p., 43 illus. London, ALLEN and HANBURYS, 1927. ISIS

Students of the history of pharmacy, particularly those who have been interested in the apothecary shop as a factor in human civilization, will welcome this volume. Not only is it well written, but as a specimen of the art of book making it will hold its own in the best of libraries. « Greift nur hinein ins volle Menschenleben, und wo ihr's packt da ist es interessant ». These words of GOETHE apply particularly to the apothecary shop that has touched mankind at so many points. It is particularly true of the old Plough Court apothecary shop and the institutions of modern pharmacy to which it has given birth.

While all of the excellent portraits are welcome to the collector of pharmaceutical biography, the fine features of DANIEL HANBURY as represented on the medal known by his name make a special appeal. The facsimile of a letter in his fine penmanship seems to reveal the Quaker of high standards as a man as well as the historian of drugs. Though he died when only fifty, yet he lived to finish, with FLUECKIGER, the « Pharmacographia ».

E. K.

Gesellschaft für Geschichte der Pharmazie. *Isis*, 10, 56-57, 1928. ISIS

Gildemeister, Eduard, und Hoffmann, Friedrich. Die ätherischen Öle. Dritte Auflage. Erster Band. XVI + 864 p., 2 maps, illus. Leipzig, L. STAACKMANN, 1928 (M. 32.00.) ISIS

Volume one of the third edition published under the auspices of SCHIMMEL & Co., in Miltitz near Leipzig, has just made its appearance. To students

of the history of science this volume is of special interest because of the first three chapters, viz.

Der Gewuerz und Spezereihandel im Altertum und im Mittelalter. With two maps : one showing the trade routes during antiquity, the other showing their expansion during the middle ages (pp. 1 to 14).

Allgemeine Geschichte der aetherischen Oele (pp. 15 to 220) with three illustrations.

Geschichte der Destillirweisen und der Destillirgeraete (pp. 221 to 262 with forty-nine illustrations). E. K.

(Merck, E.) E. MERCK Chemische Fabrik Darmstadt. Large quarto, 127 p., illus. 1928. ISIS

Some years ago there appeared, in a German periodical, an account of the personal relation of GOETHE to scientists. Most of these were pharmacists who had made a reputation in chemistry. It has been assumed that, because of this relationship, it was possible for the author of « Hermann und Dorothea » to delineate the apothecary as we find him in this epic. Somewhere the personal intercourse between GOETHE and « Geheimrath » MERCK has been described. This « Geheimrath » MERCK was no other than a close relative of the apothecary MERCK of Darmstadt.

The history of the « Engelsapotheke » in Darmstadt is an interesting one. Its contributions to pharmacy and medicine are too well known to call for special comment. The exchange of the factory property within the city for a large area of municipal property outside of the city limits and the erection of a model factory out in the country, as it were, constitute an experiment in sociology and economics that possibly deserves more attention on the part of the representatives of these fields of human knowledge. The general historian also may well afford to give more attention to this and similar manifestations of modern history at a time when problems of city growth and factory development are effecting our national wellbeing.

This volume, welcome as it has been to the student of the history of pharmacy, should be equally welcome to the historian, economist and the sociologist. Its make-up is exceedingly attractive and worthy of the publishing firm.

E. KREIERS.

VIII. EDUCATION.

(the methods of accumulating, imparting and diffusing knowledge).

55. — ACADEMIES, SOCIETIES, CONGRESSES. NATIONAL AND INTERNATIONAL ORGANIZATION OF SCIENCE.

(Societies and congresses devoted to particular sciences are classified under those sciences. For the internal organization of science — ISIS, I, 195 — see section 17).

Dehérain, Henri. L'institut de France et ses publications. *R. internat. de l'enseignement*, 48^e année, 14-35, 1928. ISIS

- Röpke, W. Die Veröffentlichungen der Kaiserlich Leopoldinisch Deutschen Akademie der Naturforscher. *Leopoldina*, 3, 149-158, 1928. ISIS

56. — BIBLIOGRAPHY.

(*Methods, Libraries*).

- Barwick, G. F. The Aslib directory. A guide to sources of specialized information in Great Britain and Ireland. Introductions by Sir FREDERIC G. KENYON and Sir ERNEST RUTHERFORD. XIII + 425 p. Published with the financial assistance of the Carnegie United Kingdom jointly by the Association of Special Libraries and Information Bureaux and the Oxford University Press, London, 1928. (L. 1.1.0).

ISIS

« This directory is divided into three sections : (a) Collections of material and information arranged under subjects. (b) Alphabetical list of towns and places where the material in (a) is to be found. (c) Index to collectors and named collections. » Thus in section 1, by far the largest (304 p.) one finds such headings as Bolshevism, FARADAY, Hebrew language, Obstetrics, etc. and under each a list of special libraries and collections. To the scholar the most useful part perhaps will be the third which will enable him to find where well known libraries or collections are now located. E.g., where is the MORRISON Chinese library? At the School of Oriental Studies, London. Where, the GERTRUDE BELL oriental collection? At Armstrong College, Newcastle-on-Tyne. Where, the FERGUSON chemical library? At Glasgow University. Where, the WHEATSTONE electrical library? At King's College, London. Where, the TAYLOR-SCHECHTER collection of Mss. from the Cairo Genizah? At the Cambridge University library. Where, Dr. BIESENTHAL's rabbinical library? At the United Free Church College of Aberdeen. Where, the AUGUSTUS DE MORGAN mathematical library? At London University, etc. I have two criticisms to make. First, there are far too many meaningless statements, such as « special library » or « departmental library ». Second, with regard to collections gathered by individuals, their death year should always be quoted, or the date of the collection. As it is, this directory will already render great services. It illustrates admirably the immense wealth of materials available to scholars in Great Britain and Ireland. G. S.

- (Cracow. Jagellonian Library). Biblioteka Jagiellonska. Katalog wystawy rękopisów i druków przyrodniczo-lekarskich. XIII-XVI Wieku, 28 p. Cracow, GEBETHNER and WOLFF, 1928. ISIS
Fine catalogue with 9 plates.

57. MUSEOLOGY

(*Museums and Collections*).

- Regnier, Robert. L'Exposition du centenaire (1828-1928). Le Muséum

d'histoire naturelle, d'ethnographie et de préhistoire de Rouen. 1928. ISIS

Contains valuable information on the Rouen museum, on FFLIX-ARCHIMÈDE POUCHET (1800-72), GEORGES PENNETIER (1836-1923), GEORGES POUCHET (1833-94), EUGÈNE MESNARD. G. S.

Regnier, Robert. Le biologiste et le conservateur de musée. Discours de réception à l'Académie de Rouen. 16 p. Rouen, Imprimerie CAGNIARD, 1927. ISIS

59. — ERRATA AND ADDENDA, no 17.

(For previous errata, see ISIS, 11, 567)

Vol. 5, 502. line 6. AL-GHUZŪLĪ died in 1412-13 (not 1212), according to HĀJĪ KHALĪFA (no. 12237, vol. 5, 598).

Vol. 7, 594, note 4. EDDINGTON, ARTHUR STANLEY; not Edington.

Vol. 8, 559. note TOUZET, passim. Read Mme. de WARENS (not Warrens).

608, 773. Russian mathematician, VASIL'EV, ALEKSANDR VASIL'EVICH.

744, note ASTEGIANO. See LYNN THORNDIKE in *Isis*, 10, 362.

Vol. 10, 227. note 4. SALZMAN, LOUIS FRANCIS; not Salzmann.

290, last note. BURKITT, MILES CRAWFORD; not Burkit.

493, footnote 8. read WORT, not word.

Vol. 11, 151. The Twenty Third Bibliography contained 1345 items (not 790).

Vol. 12, 114. footnote, last line, read Quant à KRONER voir la bibliographie à la note 32 (not 29).

Sarton's Introduction.

Vol. 1¹, 782. Note on NATHAN BEN JETHIEL. His dictionary was called 'Arûk, not Aruk.

(1) From HOMER to OMAR KHAYYAM. XII + 840 p. (Baltimore, WILLIAMS and WILKINS; London, BAILLIÈRE TINDALL and Cox, 1927).

A few other misprints are not mentioned in these errata because they are too obvious to cause any error or confusion. I wish to express my thankfulness to the readers who take the trouble to make the above-mentioned corrections in their copies of *Isis* and the Introduction. I would advise them after having accomplished that little task, to write their initials near mine at the bottom of this note, thus to indicate that these and the previous errata have been taken into account. G. S.

These and previous errata have been corrected by

The corrections have been made in the card index by

Author's Index to the Twenty Fifth Bibliography.

The Roman figures refer to centuries; the Arabic figures, to the sections of parts II and III, which are numbered consecutively from 1 to 59. This index will enable one to find more easily the papers analyzed in the present bibliography, and also to see at a glance what each writer is doing.

November 28, 1928.

FRANCES SIEGEL.

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